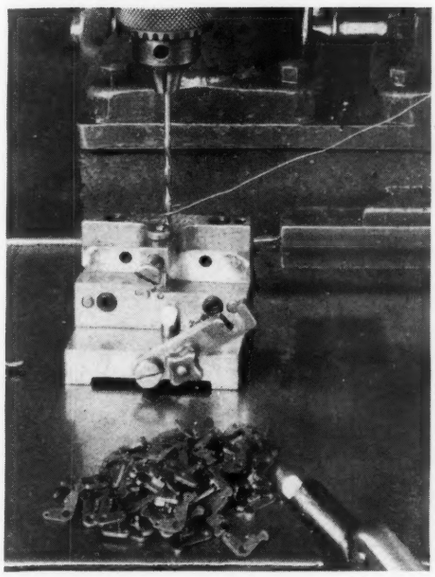

YES, THIS SET-UP for spot-facing a pawl on a single-spindle drill press looks pretty good—to anyone but a motion economist. He would discover that the distance moved per piece by both hands was 62 inches, that total distance moved per hour was 26,600 inches. Which is a lot of inches. We know you'll want to read how that distance—hence fatigue—was cut in half while output was more than doubled. All told in a June article.

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Factory Management and Maintenance is a consolidation of *Factory and Industrial Management* (including *"Factory"*) and *Maintenance Engineering*.

Price 35c a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings. Cable address "McGrawhill, New York." Member A.B.P. Member A.B.C. Copyright, 1938, by McGraw-Hill Publishing Co., Inc.

Factory Management and Maintenance, May 1938, Vol. 96; No. 5. Published monthly, McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

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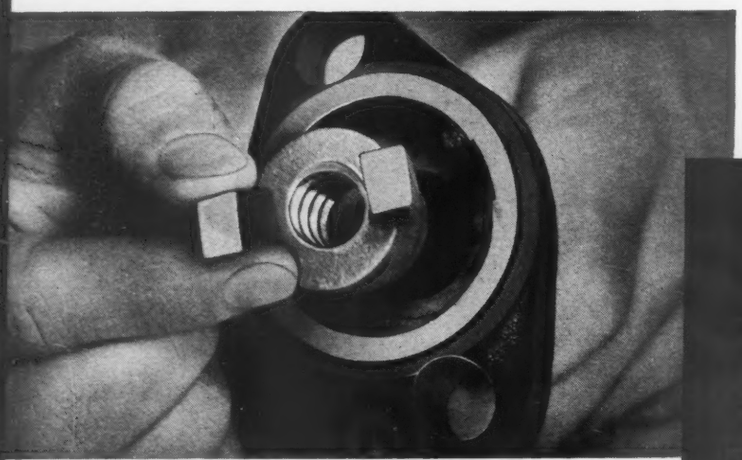

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L. C. MORROW, EDITOR

If We Go to War

ON THE TEN PAGES immediately following is an article, "Industry and the Next War." It is published to acquaint industry with the Industrial Mobilization Plan, prepared by the War Department, approved by the Secretaries of War and the Navy, and intended to be put into effect if the United States engages in war.

H. R. 9604, the May Bill, to which industry should give particular attention, is expected to provide teeth for the plan. It has been reported to the House by the Military Affairs Committee. Like other bills that are a part of the plan, it would take effect upon the outbreak of war.

The May Bill is intended to "prevent profiteering in time of war, and to equalize the burdens of war and thus provide for the national defense and promote peace." Price-fixing, conscription of labor and management, confiscation of excess profits, federal licensing—these are the things the May Bill proposes putting under control of the President. In short, there could be complete regimentation, absolute dictatorship.

Conceivably, every procedure proposed in the plan will be necessary if the United States engages in another world war. But only a major war could justify the dictatorship that would be involved. Yet a minor war could furnish the foundation on which a dictatorship could be established if legislation had already paved the way. And it must not be forgotten that, under the present National Defense Act, even a good-sized war could be fought without endangering our industrial autonomy.

Certainly the federal government should know in advance about the country's manpower and industrial resources, because it will have the responsibility of conducting the war. Surveys, plans, educational orders, therefore, are most desirable. Even drafts of legislation should be ready for use if the emergency arises.

But enacting the legislation is something else. The seriousness of passing the May Bill, for example, in advance of the emergency itself, lies in the abdication of power by Congress before the nature of the emergency is known and before the man who would be President is known. *Even the prospect of the abandonment of freedom is alarming in these days of spreading dictatorship.*

PLAINLY, the Industrial Mobilization Plan is something about which industry should know everything, and concerning which it should voice its approval or disapproval. We have seen revealed only recently the danger inherent in the hasty proposal of laws concerning which the public, and even Congress itself, were not wholly familiar. Get acquainted with the plan and the May Bill now. Tell your Congressman how you feel about them. Don't permit such extraordinary war legislation to be railroaded through on an emergency basis.

Industry and the Next War

Complete details of War Department plans that will throw industry into high gear if we have to go to war. How the lines lead out from the office of Assistant War Secretary Johnson in the ancient State, War, and Navy Building to every plant in the land. Will Congress, via the May Bill (which is now before the House), confer powers on a war-time President that will make the great dictators of history look like small fry? Is this nation of ours to be turned overnight into a totalitarian state? Are plant operating men to be conscripted? Every angle of the Industrial Mobilization Plan is explored in this timely article

CHARLES B. COATES

Assistant Editor

THE TALKATIVE taxidrivers of Washington are fairly well aware that America has positive plans for the mobilization of industry in the event of war. In this they are better informed than some of the industrialists whose plants will be vitally affected.

The Capital cabbie is prepared at all times to expound on any and every topic. He holds forth in soliloquy or dialogue, depending on whether you keep quiet or ask questions, but he is always, in high gear and low, the oracle.

"Yeah, sure," said one. "They got plans to turn this country overnight into a war machine second to none."

"Well, gosh, they must be doin' *something* in there," said another. "Just lookit the place."

He waved toward that rambling temple of antiquity, the State, War, and Navy Building. Deep in its darkest corridors, the ghosts of General Grant and his staff still clank busily about in full military regalia, but they are neglected spectres, nowadays, in an atmosphere that has been determinedly demilitarized. You will see more uniforms, medals, and swank in an hour at a midwestern military academy than you will find in the War Department in a week.

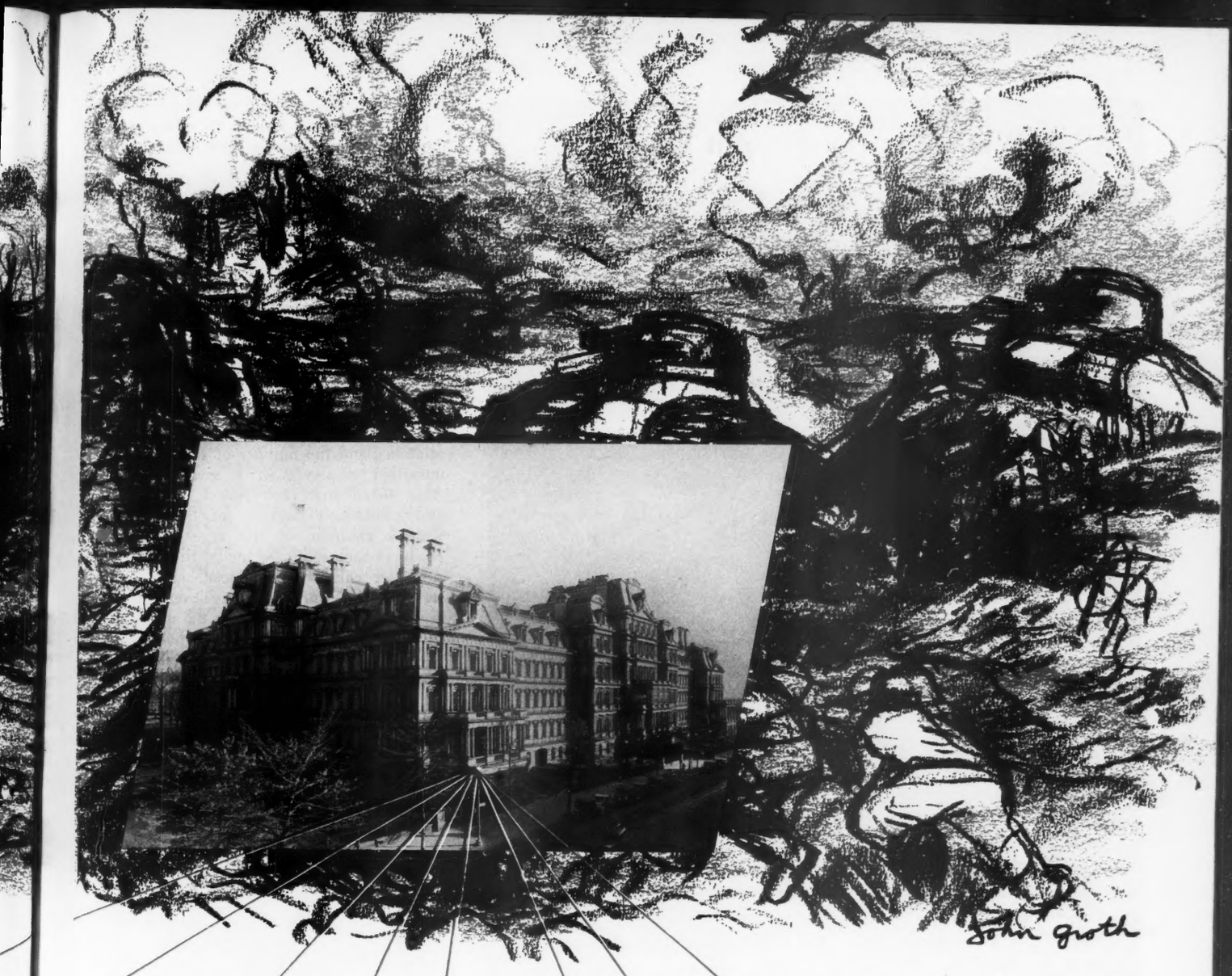
Pleasant men in mufti, all outward differences in rank submerged, go quietly about their chores with an air that is almost casual. By contrast with the grim, heel-clicking warmongers of Europe, they impart a comforting sensation that here war is still something theoretical and remote. Undoubtedly much in their manner is assumed, a matter of policy. Some of it is ingrained, a matter of habit. A good deal of it can be set down to certain fundamental differences in a democracy's way of going about any business, including the war business.

No matter. In any case, you can paste it very plainly in your hat that these men are military men, definitely engaged in preparing for war. And you can add to that the fact that your own factory, where you are now peacefully making pocketbooks, dog collars, or ashtrays, is included in their plans.

Factories now making toy soldiers will turn out knives, forks, spoons and canteens for the mess kits of real soldiers. Watchmakers and phonograph companies will rush work on mechanical time fuses for bombs. Elevator companies will make recoil mechanisms. Factories now making oxygen tanks will make bombs, of course. Women's underwear mills will make netting to protect our forces from a well-armed foe who outnumbers every army by the millions.

Some quite literal plowshare-beating will take place in farm implement factories. They will make artillery carriages. There are factories that still make farm wagons. These will make escort wagons and ambulances.

The fateful day when the war alarm clangs through the nation (if it ever does) already has a name and a nick-



name. It is Mobilization Day, the signal for the ~~nursing of~~ troops, the start of a ~~sweeping~~ industrial switch-over, and a ~~drastic revision of~~ civilian life.

Its businesslike nickname is M-Day, and on that day all industrialists—plant executives, technicians, and workers—may find themselves subject to call for government service without any choice in the matter. In the background looms the figure of a war-time President more potent than any conception of the peace-time mind. This is only a possibility, like war itself, but it is a possibility not to be ignored. If this country goes to war again, it will go on a business basis. That is the basis on which military efficiency is achieved. Individuals won't matter so much.

There is nothing oppressively military, but there is something pretty businesslike, about the offices of the Hon. Louis Johnson, Assistant Secretary of War. This broad-shouldered, affable, pipe-smoking West Virginian is a World War veteran who holds a lieutenant-colonelcy in the Reserve Corps. After a long, post-war hitch in private business, he returned to the service in 1937. Under the National Defense Act, he is charged with the administration of the Industrial Defense Plan.

We've Got the Manpower

Manpower, says Colonel Johnson, is perhaps ~~the least of preparedness~~ problems, procurement the greatest. Present plans of the General Staff call for mobilization of 1,230,000 men four months after M-Day. Within a year this figure could be doubled. But manpower, unequipped, is meaningless. An army is not really mobilized until the nation behind it is mobilized. Every generation of Americans born before 1918 has witnessed a war, yet America has never before gone into war prepared for war. Are we better prepared industrially than we were in 1917?

"Definitely," says Colonel Johnson. "We believe we can cut in half the time it took to get under way then. Our goal is a six-months' schedule for complete mobilization of industry. I hope we can soon be gaited to that pace."

This is decidedly in contrast to 1917 when it took fourteen months to set down a completely equipped division in France. Incidentally, how do current world conditions resemble the pre-war days of 1916?

"I can only say this," he replies. "Things were very hot then, to use a familiar phrase, and things are very hot now. But the question then was: 'What can America do?' Today the answer to that is well known."

And what about the radio commentator who declared recently that the Industrial Mobilization Plan was ten years behind the times, obsolete? What about the widely syndicated newspaper report in which the president of a big industrial firm asserted that he had never heard of the plan and never even seen anyone from the War Department?

"Yes, we heard about that," Colonel

Who Gets the Freight Cars?

Triangle Photo Service

Suppose you own a clothespin factory five miles up a one-track railroad spur. You have just completed a large order of clothespins, all ready and packed for shipment.

Ten miles up the spur is another factory making time fuses for hand grenades. This factory has just finished a big order of fuses. There are just enough freight cars available to carry your clothespins or the other fellow's fuses.

Well, both factories start yelling for freight cars. The outcry is heard by the War Resources Administration, a civilian board which may or may not be running the railroads but is certainly giving the railroads orders. The question is decided with no hesitation whatever. The fuses move and the clothespins wait.

In the same way, all movements of food, merchandise, and raw materials will be regulated by the government's wartime direction of priorities. Within plants, war orders will be given precedence over commercial products. The supply of fuel and power to plants will likewise be regulated.

Johnson smiles. "We looked it up and found that we had complete data on that company in our files. It happened that the firm had been in receivership. The president, a newcomer, was unaware of our negotiations with his predecessor."

Then just how complete is the plan? How recently has it been overhauled? Colonel Johnson turns to Col. C. T. Harris, director of the Planning Branch of the Office of the Assistant Secretary of War. Colonel Harris is ruddy, brisk, genial, an ordnance-trained career officer of 35 years' service.

"We have on file what we call the Allocation Schedules of Production of over 10,000 industrial firms," Colonel Harris says. "These schedules show just what these firms are producing now and what war materials they can produce. The files were brought completely up to date in 1936. About 7,000 schedules have been rechecked since. We expect to have a complete revision ready this fall."

As a matter of fact, about 20,000 plants have been studied at one time or another. The file has had as many as 12,000 listings, but it is weeded out periodically. In the next revision, many plant facilities will be assigned to the navy. The Planning Branch cooperates with the Army and Navy Munitions Board which was formed to eliminate duplications and assure both branches a smooth supply.

The allocations are concerned largely with special munitions, but there is a comprehensive file on manufacturers of quartermasters' supplies such as uniforms, boots, and blankets. The allocations system is expected to correct one of the most glaring inefficiencies of the last war when various branches of the government were bidding against one another and boosting the prices of supplies.

An allocation schedule lists the name, location, financial rating, business affiliations, and the number of skilled and unskilled employes in a given plant. Also listed are the normal products and production capacity of the plant with a notation on the type of war products that could be made, the quantity that could be produced, and the time required for the change-over. On the reverse side are notes on the method of computing the plant load, what conversion or new construction would be necessary, and the bottlenecks, if any, in the production system. Army men say much thought has been given to the question of whether plants are properly wired to accommodate additional electrical loads.

Who Will Make What?

Based on these files an industrial map of the nation has been drawn and divided into districts. No plants will be asked to devote their full capacities to war orders. (After the last war, one company took seven years to regain its peacetime markets because it was loaded to capacity with war business.) Allocations call for between 20 and 50 per cent of the capacities of the average plant. Incidentally, these allocations, contrary to the general impression, are not contracts. They are signed by plant officials and War Department officers to certify the accuracy of the data they contain, but they are binding neither on the government nor the manufacturer.

"However, manufacturers have cooperated fully in preparing them," says Colonel Johnson. "Those who have conferred with us at the War Department have not hesitated to lay their cards on the table. They have filed with us much data that they would not care to give their competitors, and we, in turn, have respected their confidence. The steel industry has been notably cooperative in the preparation of the Steel Plan for War, representing three years of study by the government and the American Iron and Steel Institute."

A daily visitor to the Assistant Secre-

tary's office is Gen. Malin Craig, army Chief of Staff and top-ranking peacetime officer. He is slim, erect, soft-spoken, the veteran of service in Santiago, China, the Philippines, and France. He holds the D.S.M. and many foreign decorations of high degree. Unmindful of these distinctions, he stands, leaning negligently against a window sill with one foot at rest on a radiator pipe. The other officers remain standing until Colonel Johnson notices their plight.

"Sit down, General, so these men can sit down," he says.

General Craig grins and sits down. The only military note struck during the conference dies away in the distance. The discussion turns to the tangles wrought by hurried industrial mobilization in the last war.

"I remember when we changed an infantry outfit over to the field artillery," says General Craig reminiscently. "And we had to drill 'em for months with logs of wood for horses and guns."

That's winning a war the hard way. There was a lot of trouble, too, about supplying the infantry with rifles. As a matter of fact, even when the soldiers got rifles, the rifles were not of the best.

"There's some truth to that," Colonel Johnson agrees. "We had to make Enfields because most of our factories lacked the jigs, dies, and fixtures needed to make Springfields."

The Springfield, an American model, was then and is still the best of bolt-operated military rifles. The Enfield is a somewhat less efficient British design. Some American factories were busy making rifles for the Allies while American soldiers were marching around with broomsticks.* What could the War Department do, another time, to get production in factories already loaded to capacity with commercial or foreign orders?

"That is fully provided for in the National Defense Act," Colonel Johnson replies. "Government orders come first in the event of war or the imminence of war."

How is the latter defined?

"The imminence of war would be determined by a Presidential proclamation of emergency," he explains.

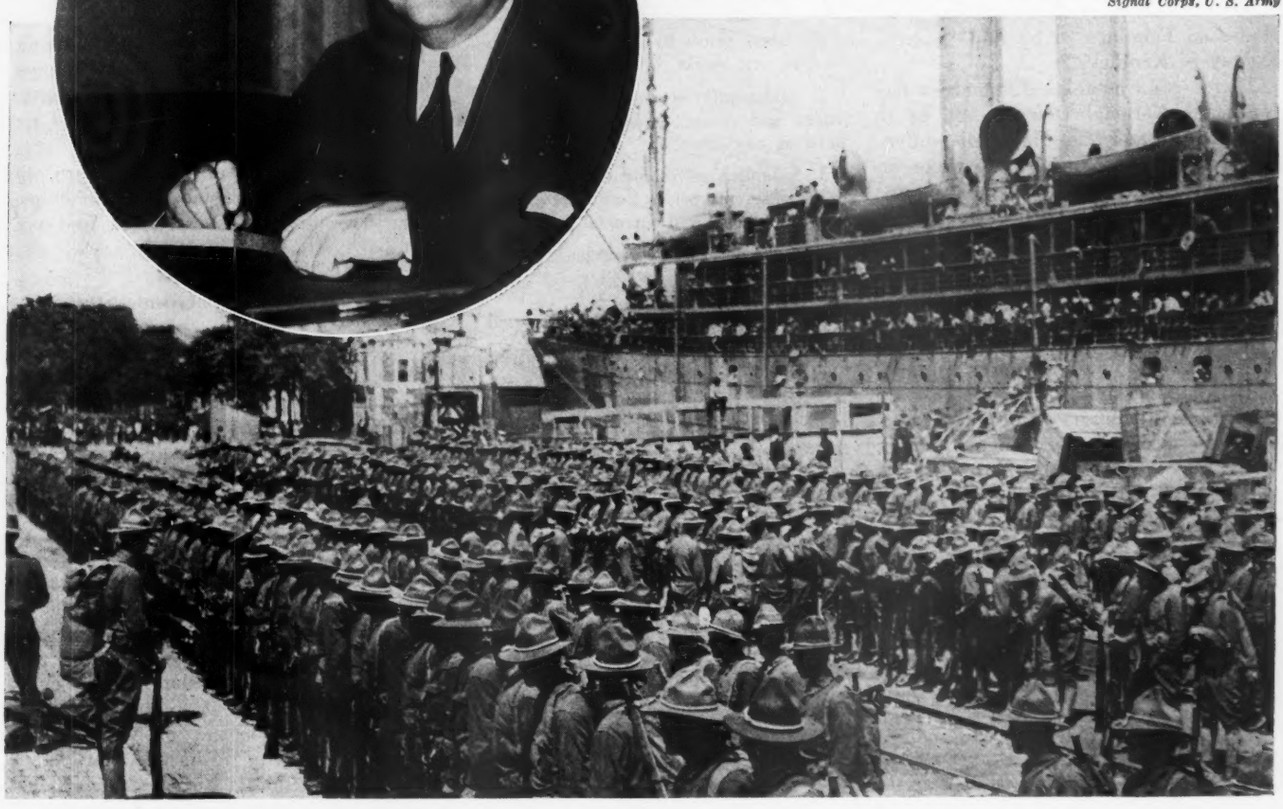
Then the government could assume a controlling position in industry even before a war began. And continue to control industry for the duration of a war. In 1917–18, we had first chaos, then a War Industries Board, and finally a fairly orderly system though filled with the faults of haste and waste. To whom, another time, would the supervision of the industrial effort be delegated?

"To civilian boards directly under the President," says Colonel Johnson. "Section 120 of the National Defense Act already gives the government much industrial authority in event of war. But we hope for early enactment of the May Bill, which was introduced in the

*Army arsenals have, since the war, completed a supply of Springfields judged sufficient to equip a war-time force. The arsenals are also said to be equipped for quantity production of the new M-1 (Garand) semi-automatic rifle.

In the World War it took fourteen months to set down a completely equipped division in France. The man charged with the responsibility of seeing that that doesn't happen again is Col. Louis Johnson, Assistant Secretary of War. "Our goal," he says, "is a six-month schedule for the complete mobilization of industry." That includes you and your plant.

Signal Corps, U. S. Army



Official photograph, U.S. Army Air Corps

Casually, quietly, the army's new "Flying Fortresses" have ripped off a series of spectacular flights—the recent South American jaunt, for example, and the even more recent 4½-hour hop from Detroit to Tampa. Army avoids fanfare. But watching world powers are mightily impressed. Even better planes are in prospect

House on February 24 by Rep. Andrew J. May of Kentucky."

There are notable differences between the National Defense Act, as it now stands, and the May Bill—differences that could, conceivably, make or break the Industrial Mobilization Plan. The authority for industrial regulation in the World War was based on the President's constitutional powers plus Section 120. President Wilson forcefully gave to Section 120 more standing, as a precedent, than it deserves on its merits. It does, however, authorize price-fixing, of a sort, and it does compel manufacturers to produce goods on order of the government or (this was a feeble threat in 1918) be commandeered. Yet its terms are vague and its penalties slight.

Section 120 is a pallid piece of business, indeed, compared to the May Bill (current successor to the Sheppard-Hill bills and other measures which have had American Legion support).

The May Bill would enable the wartime President to:

1. Fix the price of all goods, commodities, properties and rentals at any level and on any date (i.e., 10 days after M-Day he could freeze prices by proclamation as of six months, six weeks or six days previous).

2. Make any exceptions to these fixed prices and revise them upward or downward at any time.

3. Establish government control over all industrial enterprises, material resources, public services, and financial exchanges.

4. Draft for military service all men between 21 and 31 years old.

5. Draft for government service at his option all persons engaged in management or control of any industrial establishment.

6. License all manufacturers, public services, and other types of business (except publishers of newspapers, periodicals, books).

7. Declare priorities (i.e., determine which goods shall be produced and transported first, and which shall wait).

8. Create all the boards, bureaus, and commissions he deems necessary to carry out these functions.

9. Rearrange and transfer executive agencies, bureaus, powers, and functions.

The vital provisions of this bill would all be subject to such rules and regulations as the President himself would prescribe, but the extra powers of the President would terminate with the war. Individuals or firms violating any of these orders could be fined $100,000, imprisoned one year, or both. Last, the bill empowers Congress to fix a definition of excess profits. This means that if anyone were to turn up with an over-sized stack of blue chips, the Treasury could reach out and tax it back into the kitty.

Will Industry Goose-Step?

What, then, is the attitude of the War Department toward industrial control and industrial profits? Will industry march or goose-step toward military efficiency? Will an army commissar stand vigil over every factory? Or, on the other hand, will profiteers run riot unmolested?

"The War Department," Colonel Johnson replies, "is absolutely against putting army officers directly in charge of industry. It has no intention of taking over the business structure, and that is why the civilian board set-up has been worked out so carefully. We realize that sufficient profits must be allowed industry to insure and stimulate production. But we know also

that the principal obstacle that warring nations have encountered in the past in the moilization of a united public opinion behind the lines, has been the matter of excess profits and high profits.

"We ran into these difficulties in 1917–18. Hysterical competition for war materials and labor sent prices and wages to skyrocketing heights. Rents, food, and clothing jumped to new high levels. The $30 a month that soldiers were assured in 1917 had shrunk, in 1918, to less than half its original purchasing power. The average price of all commodities rose to two-and-a-half times their peace-time level. Inflation and profiteering raised their ugly heads.

A Law with Teeth in It

"Had the World War lasted much longer, our home sector might have become demoralized. What we need today is a law with teeth in it, with stringent penalties for violations, to become effective upon the declaration of war, that will attack the two evils of inflation and excess profits, and minimize the possibilities of their ruinous effects."

What other legislation is recommended by the War Department?

"The Educational Orders Bill," Colonel Johnson replies, "is decidedly needed right now to prepare certain industries for the making of special munitions in which they have had no previous experience."

This bill, sponsored by Rep. J. Joseph Smith of Connecticut, would enable the War Department to place $2,000,000 a year in small, experimental orders. Manufacturers would be reimbursed only for their expenses. In this connection, it is interesting to note that Britain's rearmament program calls for a large-scale dress rehearsal of armament manufacture through its "shadow factory" plan. O. W. Roskill, London industrial consultant, observes that British exports of machine tools have fallen off heavily with the increased home demand caused by the shadow plan, while American and German exports in this field have risen.

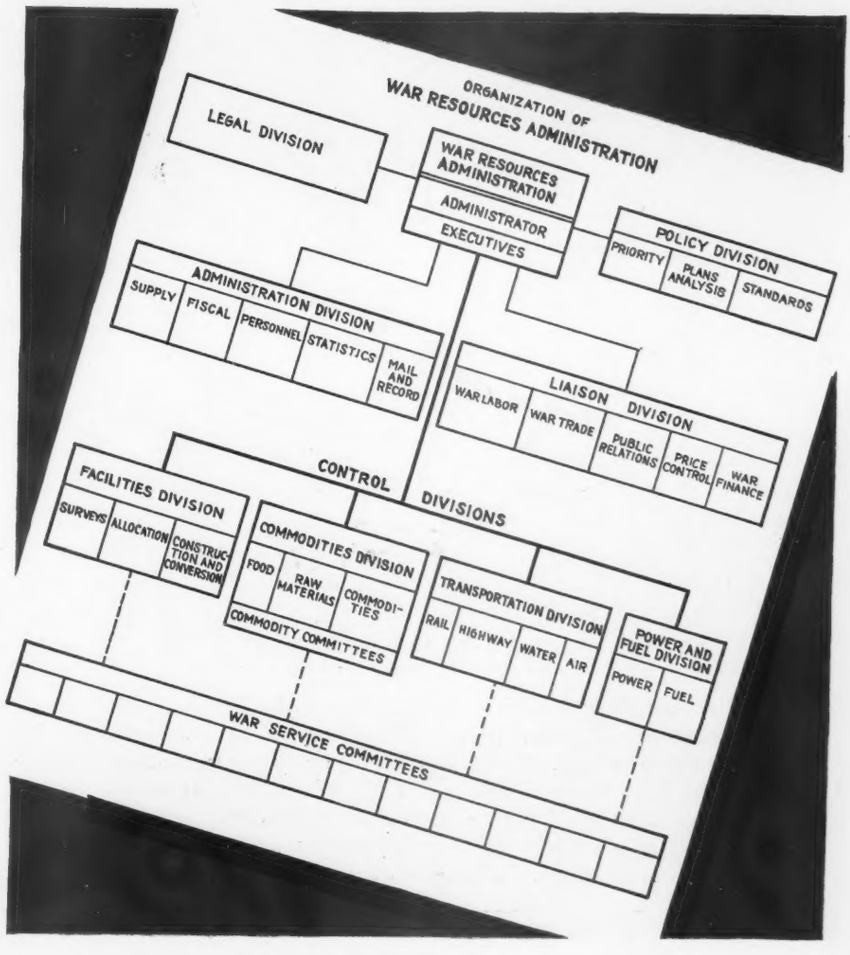
"Our machine tool industry," says Colonel Johnson, "would be the most overloaded and least prepared of all our industries, the unknown factor in the mobilization plan. In the average plant, change-over of products means not only change-over of machines, but also the development of new, skilled personnel. Not only have many advances been made in design and production of war machinery since the last war, but the number of plants with experience in this field has also dwindled greatly. At this time, moreover, when few plants are running at capacity, these educational orders would increase employment."

During the World War much confusion surrounded the making of special armaments. As late as August, 1917, we had no large artillery shells and did not know where to find them. A detail of ordnance officers, perspiring day and night, soon amassed a heap of data on plants capable of making shells and a heap of hastily drawn contracts for obtaining them, but they had few facts on the costs of orders amounting to nearly $600,000,000. Moreover, under the contracts, the government had to agree to furnish shell bars, ship them, at its own expense, to plants all over the country to get the forgings done, then ship them to still other, and distant, plants for machining. The war was nearly over when these shells began to appear in quantity.

"The educational orders plan," Colonel Johnson concludes, "is decidedly an ecomonical approach to industrial preparedness and a very cheap form of national insurance."

Now how about raw materials, contracts, railroad control, labor, and the war-time regulation of power and fuel? The answers are to be found at the enormous, factory-like Army and Navy Munitions Building with its miles of concrete corridors and its hundreds of bare, white-walled offices. Here a group of men have been pondering these matters for years. They are the officers of the Planning Branch, under Colonel Harris.

The Planning Branch developed, as a division of the office of the Assistant Secretary of War, out of the 1920 amendments to the National Defense Act. Its duties were not made wholly clear, so it went ahead and made them clear. It takes no hand in routine peace-time procurements. Instead it peers ahead,



Foundations are already laid for the war-time superagencies that will administer the Mobilization Plan. Super-superagency will be the War Resources Administration, a one-man board that will control everything in the heavens above, the earth beneath, and the water under the earth

envisions war-time needs, and arranges for their satisfaction. In war it would vanish, gobbled up by its own plans.

The material needs of the army and navy are standardized by the regular supply branches and turned over, after testing, to the Army and Navy Munitions Board for coordination. The army's requirements then go to the Planning Branch which draws up specifications and allocates them to plants for possible mass production.

Raw materials and commodities are a prime concern of the Assistant Secretary. The Planning Branch has completed a survey showing that, although this nation is the most favorably situated on earth, there are some things we lack and others we might find hard to get. A list of 22 "strategic" and 52 "critical" materials has been compiled. Manganese is perhaps the most doubtful, and most necessary, of these war materials—tin, also, to a lesser degree.

In the legal division of the Planning Branch, sample contracts have been drawn for war orders. All of them are highly tentative. Few of them allow for competitive bidding, a peace-time procedure which the urgency of war precludes. War Department men feel that the allocations system will insure a rational spread of orders. They point out that in the placing of orders for common products, such as blankets and shoes, the contracting officers can conduct informal competition among contractors. Food and forage will be purchased by competitive bidding.

Less than 20 per cent of war contracts will be drawn on the cost-plus basis, and these will be extensively revised in the light of the last war's sad experience. Cost-plus had a double meaning in 1917–18—the higher the costs, the higher the profits.

The adjusted compensation contract is the currently proposed answer to this. It provides that if a contractor can complete a job for less than estimated cost he will be paid 25 per cent of the amount saved. Another type is the evaluated fee contract with fixed rates of profit ranging downward from 4 per cent on a $100,000 order to 8/10 of 1 per cent on the last $10,000,000 of a $30,000,000 order.

All the contracts give the government's officers broad powers to inspect and reject materials, but all protect the contractors from loss through cancellation. The contracts at present presume only the authority of the National Defense Act. They could probably be made more stringent by a "law with teeth in it."

Construction contracts have also been prepared both on negotiated price and fixed fee lines. These are far more

Farther than the human eye can see, faster than the human mind can work, the American robot fire director trains this battery of four 3-inch anti-aircraft guns simultaneously in a deadly barrage. The robot spots approaching planes 15 miles distant. Automatically it calculates their speed and altitude. At five miles the battery launches a stream of 100 projectiles a minute, each calculated to explode at the planes' height. Doing logarithms in its head, the robot keeps the battery trained on the moving planes, adjusting itself instantaneously to changes of pace. At night, robot and searchlights are synchronized

tenuous than the procurement contracts because the authority for construction work is widely divided and vague. The work has been tentatively divvied up among the army's corps area commanders, the Assistant Secretary of War, and the Quartermaster Corps.

The foundations of the toweringly important war-time superagencies to administer the Mobilization Plan are being laid in the Contributory Division of the Planning Branch. There is to be a War Trade Administration, a Price Control Commission, a Selective Service (draft) Administration, a War Finance Control Commission, a War Labor Administration, and "other administrations, if and when necessary."

Mr. W. R. A.—the Big Boss

Super-superagency of them all will be the War Resources Administration, a one-man board, designed as a stop-gap to handle everything until the other administrations can be formed. Temporarily, Mr. War Resources Administrator, a civilian, will control food, power, fuel, transportation, commodities, raw materials, price-fixing, construction, and practically everything else that is in the heaven above, the earth beneath, and the water under the earth.

"Legislative authority does not now exist for some of the control measures set forth to be exercised," the War Department says, "but the plan includes drafts of such legislation."

Such legislation would seemingly be needed to empower the War Labor Administration to take over the employment service of the Department of Labor and to supersede the National Labor Relations Board, the Labor Department's Conciliation Department, and the state labor departments.

Boss man of this program will be an Administrator of War Labor. Appeals in labor disputes will be carried upward from regional bureaus to a Federal Labor Arbitration Commission in which a Director of Conciliation will hold the balance of power between five representatives of employers and five from the ranks of labor.

Primary job of the War Labor Administration will be to "protect" a supply of labor to industry by seeing that no skilled workers are packed off to the trenches if they are willing to stay home and work—and *vice versa*.

The conscription of plant operating men and technicians also requires special legislation. A tentative law entitled the Industrial Management Act, has already been drawn. In the World War the government had power to commandeer the plants of recalcitrant contractors under the National Defense Act. Yet this power was used only as a

Raw Materials

During its Ethiopian campaign, Italy accepted the League of Nations embargo on munitions with comparative calm. But when the oil sanctions were imposed, Mussolini thundered a threat of war.

Practically every raw material is a war material. Nearly half the world's raw materials lie within the borders of these United States occupying less than seven per cent of the earth's surface. We have half the world's coal, a big share of its oil, iron, copper, zinc, and lead, and a smattering of nearly everything else.

America is a big consumer, however. It imported, in good old 1929, about $1,000,000,000 worth of raw materials and partly finished goods. The War Department thus assumes that we are not quite self-sufficient. It takes the long, pessimistic view and envisions a situation in which we are cut off from all foreign supplies, from our own insular possessions and even from Alaska—although the navy would probably take care of that very nicely.

On this assumption is based the War Department's list of 22 "strategic" and 52 "critical" materials. Strategic materials are those, essential in war, for which we might have to go to outside sources. Critical materials are either less essential or less difficult to get.

The strategic group includes manganese, chromium, mica, quinine, tungsten, aluminum (because foreign bauxite is better and cheaper for some uses), antimony, coconut shells (for making carbon filters in gas masks), tin, wool, coffee, hides, silk, sisal, nickel (Canada has plenty), opium, quicksilver, iodine, jute, optical glass, Manila fiber, and rubber.

The one you hear most about is manganese, essential in making steel. The War Department would like to store up a quantity of foreign manganese, like France which is said to have a four-year supply.

Most manganese comes from Russia, India, Brazil, and the African Gold Coast. In Cuba there is good manganese. And in the United States there are certain deposits. The War Department says the domestic ores are "low grade and can be made domestically useful only by application of expensive concentrating processes." There is now before Congress a bill for government acquisition of $40,000,000 worth of American manganese. Meanwhile the Navy Department has, on its own initiative, ordered 11,500 tons of the domestic product.

Rubber is another big item. We grow none, import 1,000,000,000 lb. a year. Great Britain controls 65 per cent of the world's supply, the Netherlands 20 per cent. Cut off from foreign sources, we could draw first on our stocks, which run about six months ahead. An additional supply could be gained from reclamation of waste rubber. (Du Pont has a synthetic substitute, Neoprene, made from domestic materials, although at several times the cost of real rubber. The War Department says U. S. Rubber is experimenting with Neoprene tires.)

Even in peace time, we import about a third of our wool. In war time we could probably supply the army and navy, but the folks at home might have to get along on shoddy and cotton. So it is with silk. Japan produces 75 per cent of the world's silk; we buy 70 per cent of Japan's silk. China and Italy are silk producers Number Two and Three. Silk is used to make powder bags and parachutes.

Tin is another major strategic material. We get all our tin from foreign sources—Malaysia, the Dutch East Indies, Bolivia, Siam, China. In peace time we use 30,000,000,000 tin-lined steel cans a year. There is thus a sizable supply of scrap. Substitutes are in the offing. Food can also be preserved in glass.

Our world trade in raw materials is a neutrality problem, a peace-time economic problem, and a defense problem. Nothing now, save the somewhat loose discretion of the President under our neutrality law, prevents exportation of any or all of our domestic supplies.

Contracts

Three sample war-time contracts have been drawn up. All three include a termination clause, allowing payment for work done to date but applicable at the government's will. (After the last war, the government was stuck with some big orders.)

1. NEGOTIATED-PRICE CONTRACT

Four out of five contracts will be drawn under this form which allows a leisurely, round-table discussion of prices between contracting officers and manufacturers. Procurement of the more common supplies, whose prices are generally established in the commercial market, will be conducted under this type.

Prices of all raw materials and finished goods may possibly be frozen even before the declaration of war. This would simplify price negotiation, but its effect on contractors is difficult to foresee. In the last war, the benefits of price-fixing were unequally bestowed. The Federal Trade Commission noted later that big-scale, low-cost producers were "further strengthened in the position and enriched by profits which are without precedent." The late Robert S. Brookings concluded, however, that it was neither the largest nor the smallest corporations that profited most.

"It was rather," he said, "the medium-sized corporations which had attained volume enough for efficiency coupled with a certain flexibility, frequent turnover, and the more intense service of ownership that often proved to be the most profitable."

2. ADJUSTED-COMPENSATION CONTRACT

This is a form of cost-plus contract in which the War Department believes it has eliminated the objectionable features of the hurried agreements of World War days. It is to be used where immediate production is paramount and the cost agreement is postponed.

For example, a contract is placed for an order on which the contractor estimates the cost at $100,000. The government guarantees his costs and a profit of 6 per cent on capital investment.

"However," says the Contracting Officer, "if you make 'em for $80,000, we'll give you 25 per cent of the saving."

That's an extra $5,000 for the contractor and a saving of $15,000 for the government. If, on the other hand, costs exceed estimates, the contractor can be penalized half of his profit.

3. EVALUATED-FEE CONTRACT

This is another rush-work contract with cost-plus features. It is titled a supply contract but the Legal Division says it will be used only for construction work. It pays a 6 per cent rental on facilities, plus costs. The scale of profits ranges downward from 4 per cent on a $100,000 order to 8/10 of 1 per cent on the last $10,000,000 of a $30,000,000 order.

Seemingly this contract would have to be administered with the utmost care. The sliding scale makes little orders more profitable than big ones. The wrong Contracting Officer could let a $10,000,000 order in ten contracts with a loss to the government of $110,000.

This contract contains one feature not to be found in the others. It specifically forbids big executive salary increases and booming bonuses for everybody after war is declared.

threat, an empty threat. The government simply had no way of running commandeered plants because it lacked the necessary technicians.

The Industrial Management Act (which would need something like the May Bill to back it up) would change all that. It empowers the President to:

1. Order the registration of "all or any class of persons engaged in the management or control of any technical, industrial, or manufacturing plant."

2. Bring into the government service, at his pleasure, anyone so registered who shall then be at the service of the Secretary of War.

The Secretary of War could then:

1. Establish rules and regulations for the government of "such persons" so brought into service.

2. Remove "such persons" from one industrial establishment and assign them to any other service in the War Department's jurisdiction.

This means that you could be called off your present job and put to work in another job in another corner of the country. Your salary would be fixed by the Secretary of War. If you received salary or other compensation from any other source, you would be subject to a fine of $10,000 or imprisonment of 10 years. War Department men say they have no intention of shunting men about the country willy-nilly or working them at low salaries, but the power to do so is written in this bill.

Here, perhaps, is a partial answer to the problem of staffing the proposed superagencies, however. It is said in the War Department that much thought has been given to the actual personnel of the various administrations and commissions. If every administrator and his entire staff were already selected, it would be unwise, obviously, to poke into the pigeonholes where those names are kept. For the same reason, it would be difficult to say just how many of the thousands of subordinate jobs the government is prepared to fill in order to handle the vast tasks of auditing, inspecting, and checking that go with planned economy and price control.

Kidnaped 600 Experts

The late Robert S. Brookings related that the War Industries Board found itself up against the same problem when it undertook price control. It thereupon kidnaped the entire staff of 600 research and financial workers in the Federal Trade Commission.

Perhaps other existent boards and bureaus could help. At the outset of the World War, the federal government had 476,363 civil employees. In 1937 it had 841,664. For some years the army's Industrial College has been graduating 60 men yearly who are trained in the workings of the Industrial Mobilization Plan. On file in the Planning Branch is a long list of reserve officers with data on their technical training, experience, and possible future duties. The files of the late NRA are also available, for what they may be worth in localizing the program.

Yet this—undoubtedly one of the three biggest question marks in the material blueprint of the industrial mobilization set-up — must remain a question mark until put to the practical test. The other two—adequate plans for construction work, and adequate machining and tooling of special

munitions—may be solved, in the fullness of time, by the Planning Branch of the War Department.

There is one transcending question, however, which no plan can answer. Who would be the war-time President of the United States, and how would he employ his tremendous executive powers? There are perhaps three men in the world, one in Italy, one in Germany and one in Russia, who have anything like the authority that the May Bill would confer on our war-time President. All the dictators of the past, from Genghis Khan to Napoleon, would shrink shyly into the shades of history by comparison with this colossal figure.

Blueprint of Dictatorship

The May Bill (H.R. 9604) is entitled, "A bill to prevent profiteering in time of war and to equalize the burdens of war and thus provide for the national defense and promote peace." The historian, Charles A. Beard, calls it a "bill for the enslavement of the American people." Administered by a President with the wisdom of the ages and the justice of Solomon, it could fulfill its stated purpose. The power is there, written in the bill.

But plans, as every business man well knows, are plans. And practice is practice. Gen. Hugh S. Johnson, analyzing the May Bill, asserts that it would give the war-time President "the powers of a dictator." He cites other war measures which propose "to tax away almost all profits and incomes."

"These are supposed to be a means of defense, but the real idea is to make war so much of a burden that the nation will never stand for its declaration," General Johnson says. "The purpose is praiseworthy, but it should not prevail."

To this extent, then, M-Day is X-Day for all of us. And the Industrial Mobilization Plan, especially as it involves the May Bill, is an irresistibly forceful plea for peace. In every line it holds forth the inexorable prospect of production for destruction, of drastic governmental regulation, of mounting governmental debt—of everything, in fact, that injures industry in its normal pursuits. The Plan merely makes the best of a bad matter and no one knows this better than the men who made the Plan. James T. Shotwell of the Carnegie Endowment, a noted pacifist, has said that the soldier's task "is often to correct the mistakes of government."

The Industrial Mobilization Plan represents the arduous, patriotic work of hard-headed military men who recognize a totalitarian economy as one of the inevitabilities of war. What seeds this might sow, what harvest we should reap in the whirlwind, no one can say. But the Industrial Mobilization Plan, or something like it, and the May Bill, or something like it, rank among these inevitabilities. War psychology makes all legislation possible.

"Efficiency in war is desirable," says the War Department in the foreword to the Plan. But—

". . . . effectiveness is mandatory."

"It is conceivable," says the foreword, "that a war might be conducted with such great regard for individual justice and administrative efficiency as to make impossible those evils whose existence in past war is well known." But—

"It is also conceivable that the outcome of a war so conducted might be defeat."

Typical War-Time Products

BOSTON	
Leather and leather products	Artillery instruments
Shoe machinery	Searchlights
Wool	Ships
Textile machinery	Precision instruments
BRIDGEPORT	
Rifles and machine guns	Brass components for artillery ammunition
Small-arms ammunition	Precision instruments
Fuses for artillery ammunition	
CHICAGO	
Telephones, radio, etc.	Tanks, armored cars, and tractors
Artillery and artillery ammunition	Railway equipment
Clothing	Meat
DETROIT	
Automobiles and trucks	Tractors and trailers
Special motor vehicles	Airplanes—large-scale production in time of war
Tanks and military cross-country vehicles	Artillery ammunition and artillery
LOS ANGELES	
Airplanes and accessories	Moving pictures
NEW YORK	
Clothing	Fuses for artillery ammunition
Raw material import center for rubber and tin	Searchlights
Shipbuilding	"Iron pilots" (Devices for keeping ships or aircraft on a predetermined course)
Electrical appliances	
PHILADELPHIA	
Locomotives and railway cars	Armor plate
Artillery and artillery carriages	Radio equipment
Artillery ammunition	Clothing
PITTSBURGH	
Artillery	Iron and steel for manufacturing in other industrial centers—billets, wire rod, flats, structural shapes
Artillery ammunition	
Armor plate	
Glass	
ROCHESTER	
Optical lenses and prisms	Telephone and radio production
Fire control devices	Small arms
Photographic appliances	Precision instruments
ST. LOUIS	
Chemicals	Explosive chemicals
Small-arm ammunition and artillery ammunition	Shoes
	Leather equipment
SCHENECTADY	
Electrical generating units, steam and water power	Radio equipment
	Searchlights
Electric railway locomotives	Artillery ammunition
WILMINGTON	
Synthetic rubber and fibers	Chemicals
Plastic moulding compounds	Powder and high explosives

Foreman and Foremen

JOHN RICHELSEN
Personnel Director
Vanadium Corporation of America
Niagara Falls, N. Y.

. . . must be modest or his fellow-foremen will resent his assumption of leadership

PRACTICALLY ALL of us have to work with other people. And they are just as chock-full of the same human nature, with its good points and with its cussedness, as we are. How these other people act, has much to do with our own fortunes.

A foreman, for instance, is merged with the bunch of foremen in his plant. With them he develops an indifferent, sloppy, or even antagonistic state of mind. Or with them he advances steadily in efficiency through a progressive, cooperative spirit.

A foreman who is happily grouped with those in whose company he is making self-improvement and business progress should hesitate long before he casts himself into new associations. A change is always a speculation.

I don't intend to picture the individual foreman as a dead fish who must be carried along willy-nilly with the stream. The other foremen may be asleep from the neck up and an individual foreman may still keep himself alive—at least for a while. And it's just as possible that other foremen may be aggressive while an individual foreman continues to be a dud. The wide-awake foreman, in all likelihood, will find others like himself in the group with whom he can associate.

If He Has the Makin's

If a man has the real stuff in him for foremanship, he shows it first of all in the handling of the men under him. And if he has the makings of leadership among foremen, if he is the sort who will get still higher up before he is through, he will prove himself a power in his associations with his fellow-foremen. Here it is that the foreman with brains and spirit and common sense can exercise his talents.

Such a foreman must be modest, or his fellow-foremen will resent his assumption of leadership. He must repress the temptations to make grandstand plays, even if others step aside to let him make the circus catches. He must be genuinely unselfish and without jealousy, being glad to see others succeed with him. A foreman who can sell himself such a course of conduct doesn't need to worry about being duly recognized by the management.

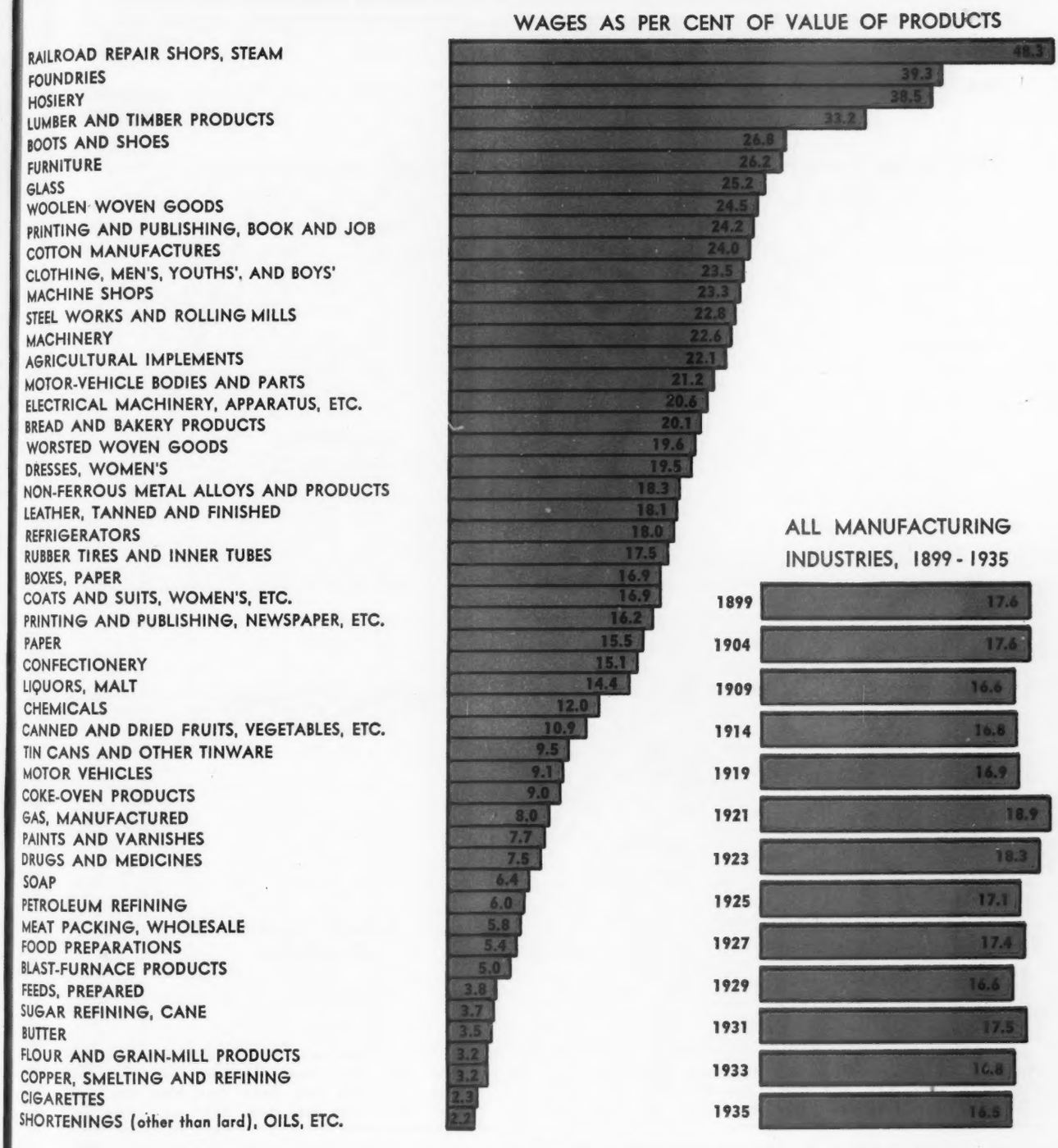
The efficiency level of a group of foremen is not necessarily permanently fixed, but may fluctuate. Human nature under proper stimulus has marvelous power for good. The passing of a year may see the same group of foremen deteriorate or pep up miraculously. A number of fair-to-middling foremen, inclined to be alibi artists, may have a bombshell dropped into their midst to wake them up and put ginger where there was lead.

Of course a foreman can quit. But quitting is always a desperate move, and quitting once will make us quitters more easily the next time.

Regardless of what our jobs are, among the "musts" of life is the necessity of working with others who inevitably affect our own prospects in life. We may be fortunate in being with those who help us. In that case we owe it to decency and to our associates not to let them down. We may be thrown into associations where we can only survive by our own leadership—or by quitting. If there is a chance to improve the morale of a group of foremen, there is a chance of being not only a good foreman but also a leader of foremen. And that means a chance for real advanced placement.

Wages and Value of Products

50 Leading Manufacturing Industries, 1935



"50 Leading Manufacturing Industries" comprises the 50 industries which in 1935 reported the largest total value of products. "Wages" represents the total wage disbursements for the year in each industry.

The small chart shows the per cent of wages to value of products for all manufacturing industries in each census from 1899 to 1935.

Source: Census of Manufactures, Department of Commerce.

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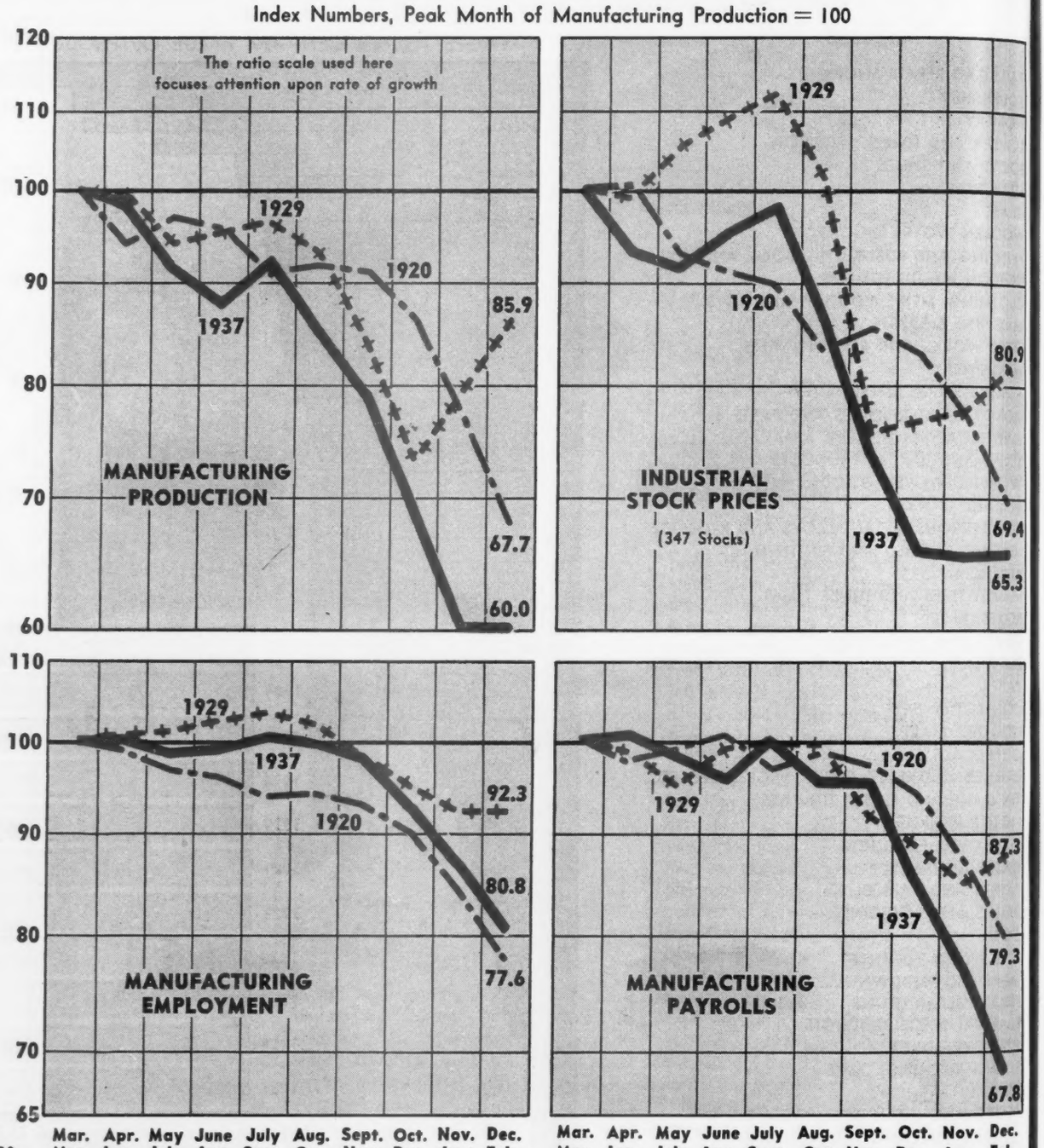
Velocity of Recession

Manufacturing Industry, 1920, 1929, 1937

Index Numbers, Peak Month of Manufacturing Production = 100



The index number base in this chart is the peak month of manufacturing production preceding the beginning of the decline. The chart shows the decline of manufacturing production in each recession through nine months following this peak, with the changes in stock prices, employment, and payrolls during the same period. The speed and extent of the 1937 recession exceeded the corresponding movements in the first nine months of the 1920-1921 and 1929-32 depressions, with the exception of employment in which the decline in 1920 was greater than in 1937.

Sources: United States Bureau of Labor Statistics; Federal Reserve Board; Standard Statistics Company.

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Sat Down and Wrote Up the Do and the Why

Wolverine supervisors and engineers pooled their experiences, wrote standard procedures for every plant job. They learned a lot they didn't know before, cut training costs, left no room for alibis

O. Z. KLOPSCH
Vice-President
Wolverine Tube Company
Detroit

WHEN you try to tell a new employee how to do a job, you have a job on your hands. It's easy to forget some important little twist, and, if he is exposed to more than one instructor, he will probably be shown as many ways of doing a thing as he has teachers. When we undertook to study jobs in our plant we found that our supervisors had different ideas and methods for getting work out. So we had to develop standard procedures.

In most cases individual techniques were good, and we wanted to keep them, passing along to our new men the benefits of these varied experiences. But too often these supervisors, experts in their respective fields, did not have details fixed firmly enough in mind to instruct their men, or long familiarity with the work caused them to fail to explain points that to them seemed obvious. In either case employees suffered, and training was unnecessarily prolonged—hence, unnecessarily expensive.

Meet Every Saturday

So we took stock of methods, and sought to have the organization agree on the best way of doing each job involved in manufacturing many kinds and sizes of tubes for the refrigerator, automobile, and other industries. Methods were desired that could be developed through the cooperative thinking of the organization, methods that could be used for improving and shortening the training of new employees. If the employees knew the *do* and the *why*, jobs would be more interesting to them as well.

Two years ago, weekly meetings were begun and have been held regularly every Saturday morning since. All plant supervisors and engineers were included, the purpose being to write a specification for every job in the plant, which by mutual agreement would be the best way of doing that job and would at the same time eliminate waste effort. Of course job analyses or job specifications are not new, but job analyses done on a cooperative basis, with operating and functional supervision participating in the details of their preparation, are.

The supervisor of each job, furnace casting for one and billet receiving for another, explained to a group just what was involved in that job. Points were written down on a blackboard and revised until an acceptable statement, understood by all present, was secured. This became the standard practice.

Not only were the *do* parts of the job listed, but after each element of the *do* there was placed an explanation of *why* it was done that way, in order to fix the *do* element in mind. If, for example, I should tell a driver to go to the station by Street *A* he would quite likely forget and go on to *B*, but if, in explanation, I told him that *A* was free of car tracks and less congested, he would be more likely to follow instructions because he could see the reasons behind them.

Our methods improved as we went along. Instead of saying: "Pour proper

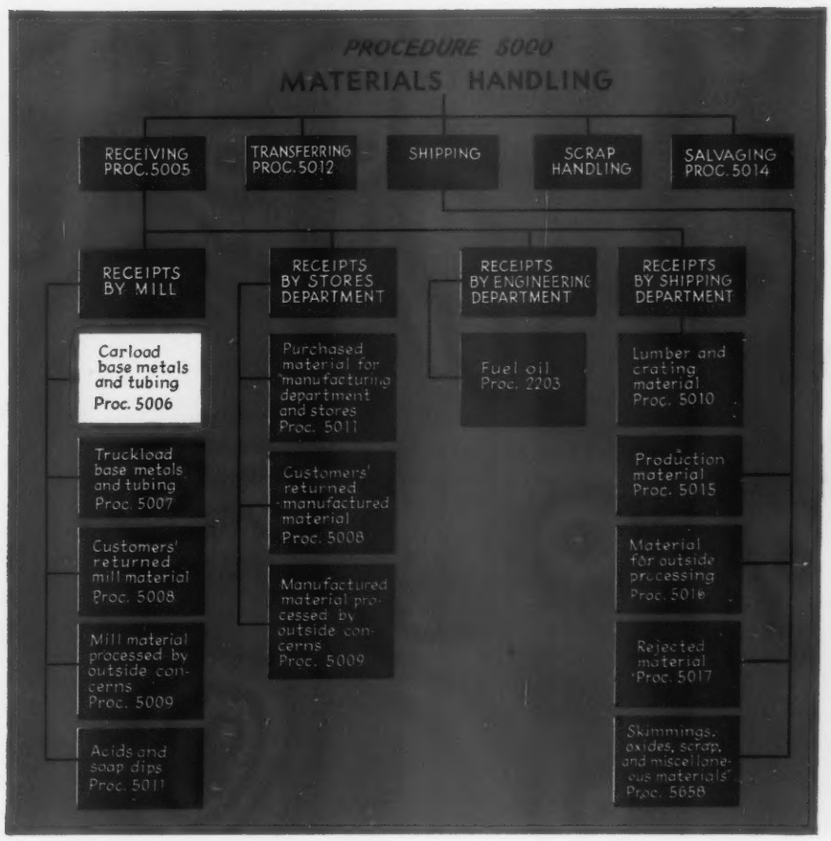
PROCEDURE 5000
MATERIALS HANDLING
RECEIVING PROC. 5005
TRANSFERRING PROC. 5012
SHIPPING
SCRAP HANDLING
SALVAGING PROC. 5014
RECEIPTS BY MILL
RECEIPTS BY STORES DEPARTMENT
RECEIPTS BY ENGINEERING DEPARTMENT
RECEIPTS BY SHIPPING DEPARTMENT
Carload base metals and tubing Proc. 5006
Truckload base metals and tubing Proc. 5007
Customers' returned mill material Proc. 5008
Mill material processed by outside concerns Proc. 5009
Acids and soap dips Proc. 5011
Purchased material for manufacturing department and stores Proc. 5011
Customers' returned manufactured material Proc. 5008
Manufactured material processed by outside concerns Proc. 5009
Fuel oil Proc. 2203
Lumber and crating material Proc. 5010
Production material Proc. 5015
Material for outside processing Proc. 5016
Rejected material Proc. 5017
Skimmings, oxides, scrap, and miscellaneous materials Proc. 5658

Figure 1. Procedure 5000 is an outline of handling operations. Detailed methods for unloading cars of base metals, for instance, are found in Procedure 5006 (see white panel), which is shown in part on the next page

amount of metal in ladle," and in the explanation: "Operator must know what proper temperature is," we state instead: "Pour approximately 500 lb.," and in the explanation column: "Bring to 2,000 deg. temperature."

When we came to develop the explanations, the value of cooperative effort was shown. A furnace foreman in describing his job could tell what he did, but too frequently not why; the metallurgist present in the same meeting could furnish this information. Operators as well as supervisors are more likely to follow correct methods if they understand the technical reasons for them.

Standard Procedures

Materials handling, inspection, casting, and the mill departments, such as drawing, annealing, coiling, and sawing, have been studied and detailed in the way described. Each major function is broken down into logical components and studied. Figure 1 shows Procedure 5000, the materials handling outline. If, for instance, we are looking for the standard procedure to be used in receiving billets, the subdivision "Carload Base Metals and Tubing" refers us to Procedure 5006, shown in Figure 2. This division is made by the Standards Department which also assumes charge of the write-up.

Completed procedures are recorded, and a copy is given to the supervisor concerned. A copy is also posted in the department where employees can consult it. When a task is done incorrectly the supervisor takes the man who has made the mistake over to the board and goes over the correct way of doing the job.

The chief inspector is now using the inspection procedure as a basis for a series of educational meetings for his inspectors. This has been quite revealing, because reactions of these inspectors while on the job have shown that foremen inspectors have taken too much for granted while instructing people.

With supervisory and technical talent assembled to make a microscopic examination of each job, it would be strange indeed if no improvement in methods resulted. Such changes were found to be an important byproduct, and while these occurred in every job, the following two examples may be considered typical.

Usual practice has been to make out a special order for the Crating Department distinct from the shop order, but the query was raised in the meeting as to the necessity for this additional detail, and now a copy of the mill order is all that is required to prepare the crating material. The Receiving Department formerly shipped back rejected material, but since they are not shipping specialists, the group suggested that the matter be handled by the Shipping Department, and the suggestion was carried out.

PROCEDURE 5006

II. RECEIVING BILLETS FOR EXTRUSION

OPERATIONS	*EXPLANATIONS*
A. When authority is given by the Inspection Department, proceed with unloading.	
1. Go with inspector to car. He unlocks door and hands over door seal. Give seal to weighman for attachment to F-56.	If inspector in originally opening car for inspection finds seal missing, he gives Receiving a note in place of the seal.
2. Open car and remove blocking to unload.	
3. Place auxiliary chute or conveyor in position at the car.	The billets are fed into a gravity chute at the car and slide to the receiving end inside the factory. A loose section of chute is required for connecting the stationary chute to car.
4. Spot a lift-truck platform or flat at lower end of the chute so that minimum carrying of billets will be required.	Clean flat of all chips or dirt. Also scrape or sweep floor where billets are to be stored. This prevents possibility of billets picking up steel chips and other foreign matter.
5. Apply metal foot guards when handling billets.	An important safety measure.
6. Get billet tongs for lifting the billets.	Be careful to use only such as are in proper mechanical condition. Return defective tongs to Engineering Department.

Figure 2. Shown here is the second part of Procedure 5006 (see white panel in Figure 1), which covers the handling of cars of base metals

We have a safe shop. In going over our jobs with a fine-toothed comb, however, we were in a position to indicate in these standard procedures just where safety precautions were required and what they should be.

Perhaps you may say, "Why not have a specialist analyze the jobs and write up the standard practice?" We discarded this idea for the reason that we wanted to draw out the talent in our supervisory force, to make it their baby and thus insure its being used to best advantage.

The cooperative development of these procedures has served, of course, as an object lesson to the supervisor, and has made him realize that a better job of training could be done. It has been easy to point out indirectly that there are better ways of training a new man on the job than letting him become an expert by trial and error.

Our experience with this program during the past year has vindicated all hopes and thoughts we had about it when we started. Most important of all perhaps is the improved thinking throughout all levels of our organization, analytical thinking if you please, about the details necessary in a proper job of instruction. We now see more clearly than before the start of the program that managing is not so much giving orders as it is devising proper and better ways of doing a job, and explaining these to the man who is to carry out the details. Our organization is more company-minded. Our work is more interesting to all concerned, for we not only know specifically what the jobs are, but also why they are done as they are.

WANTED! 1001 *Ideas*

You men who operate plants in the manufacturing industries:

It's your job to cut costs—ours to help you. Here's how we propose to do it.

You tell us about some of the cost-cutting ideas you have used successfully in your plant. We publish them. Then your idea, either "as is" or in modified form, goes to work for some other fellow in some other plant. Some other fellow's idea goes to work for you.

In fact, we'll be surprised if a dozen other fellows' ideas don't go to work for you. That's how this business of swapping ideas operates. You invariably get more than you give.

What we want specifically is cost-cutting ideas of the type published every month as *"Operating Shorts"* (see page 112). Somewhere in your plant or in your department there are scores of them. You know where they are. You know what they've saved, how they've improved quality, or made your plant a better plant to work in.

So . . . why not tell us about them? To get a little of the competitive spirit into this thing, the editors are offering $500 in special awards. Your cost-cutting idea may win one of them. If it doesn't, but if it's still good enough to accept and publish, we'll pay for it at regular *Factory* rates.

You don't have to be a "writer." It's the idea, not literary ability, that counts. Just tell us in your own way. But keep it short—not over 300 words.

You have until August 15. *But do it now.* Winners of the *Factory* awards will be announced in an early subsequent issue. Of course you can submit more than one idea if you want to.

$500.00 *in Special Awards*

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Yes, I'll send in a Cost-Cutting Idea between now and August 15. Meanwhile enter my name as a contestant for the *Factory Awards*. Hope I can have a copy of

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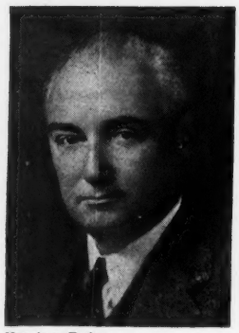
RULES

1. You can enter a cost-cutting idea in competition for the *Factory Awards* if you are regularly employed in the manufacturing industries. You don't have to be a subscriber to *Factory*. Your idea may be as short as you care to make it. But it must not exceed 300 words. Send in more than one if you like.

2. Remember the old Chinese proverb: One picture's as good as 10,000 words. If you have a photograph or a drawing that helps to make your idea clearer, let's have it. But a picture is not essential.

3. Mail contributions not later than August 15, 1938, to L. C. Morrow, Editor, *Factory*, 330 West 42d St., New York, N. Y. Winners of the *Factory Awards* will be announced in an early issue thereafter. Duplicate prizes in case of ties. Judges to be announced in June *Factory*.

4. All material submitted at sender's risk. The editors reserve the right to publish prize-winning ideas, also other ideas accepted and paid for at regular rates.



Harris & Ewing

It's This Way in Washington

Looks as if the President will have a tough time with Congress from now on. The boys are looking out for Number 1. And that no longer requires voting with the President, right or wrong

CARTER FIELD
Washington Correspondent

"FOLLOW the leader" seems to have passed into history, so far as the relations between President Roosevelt and Congress are concerned. There is still the leader, but the list of those who have followed him on every single roll call is beginning to get skimpy.

Of special interest to business men generally, manufacturers especially, is the fact that the trend away from the Roosevelt leadership is conservative. As this is written the President is having tremendous difficulty saving even a face-saving remnant of the pet Administration tax on undistributed corporation earnings. He has but recently suffered the most serious setback since the Supreme Court enlargement bill—the vote rejecting the reorganization bill.

Main question in every Democratic congressman's mind—and bear in mind that the overwhelming majority of both House and Senate are Democrats—is whether the President is, any longer, able to beat his opponents and elect his friends.

There was a good deal of comment during the reorganization bill fight in the House over the fact that the one man most potent in defeating that measure was John J. O'Connor, of New York, chairman of the Rules Committee. It was recalled that O'Connor had been a candidate for the Democratic leadership of the House, but that the Roosevelt influence threw the election to Sam Reyburn, of Texas.

This came on the heels of the utter defeat for the President's idea about taxes on undistributed corporation earnings, and capital gains taxes in the Senate. This fight was led by Senator Pat Harrison, of Mississippi. Again it was recalled that it was terrific White House pressure that defeated Pat for Democratic leader of the Senate, by one vote, and elected Senator Barkley.

Voting with Tears in His Eyes

This recollection was not calculated to inspire more "follow the leader" spirit, for every member of the Senate recalled that, just before that vote on the Senate leadership, Senator Dieterich of Illinois came to Harrison, almost with tears in his eyes, and said he could not carry out his promise to vote for Pat because the White House insisted he should vote for Barkley.

This loyalty proved of little political use to Dieterich. The President failed to persuade either the Kelly-Nash machine in Chicago or the Governor Horner machine in downstate Illinois to support this devoted White House senator. So he fell by the wayside. The Illinois Democratic primary named Representative Lucas, who had actually made a public speech denouncing the President's Court bill, who had bucked the Administration on the wage-hour bill, and had not even bothered to come to Washington to vote on the reorganization bill!

Moreover, the Kentucky Democrats are by no means certain to support the President's right bower, Barkley, for whom so much White House pressure was turned on. Reports from the Blue Grass State indicate that Governor "Happy" Chandler has the edge in that fight, which would retire Barkley to private life.

Not that Chandler is against the President, but, the logic goes on Capitol Hill, why bother to be regular if the President is powerless to help you when you come up for renomination, much less reelection?

Reelection is another story that does not help the "follow the leader" spirit. A recent consensus of forecasts compiled by a weekly magazine showed that even Jimmy Roosevelt and Charles Michelson and Emil Hurja expect some Democratic congressional losses this fall.

The boys are therefore keeping their ears to the ground and overlooking no opportunity to find out what the folks back home think. They had plenty of reaction to the reorganization bill. Regardless of organized propaganda, individual congressmen found out through sources they trusted that many of their constituents didn't like it—even many who liked Roosevelt very much, and would vote for him again.

This last is the really important discovery the congressmen have been making—that there are lots of voters still apparently devoted to Roosevelt who may be vigorously opposed to this or that of the Roosevelt objectives, or this or that one, or six, of the Roosevelt cabinet members or other lieutenants.

Next dull thud that followed the reorganization bill defeat for the President was the lack of enthusiasm out in the country, as relayed in various ways to the congressmen, for the spending message and fireside chat defending it. Not only was there a lack of enthusiasm, but plenty of downright opposition—not so much to feeding the hungry as to embarking on vast new public works.

As a matter of fact the President came to this himself after much travail. He had hoped to avoid it. He encouraged Henry Morgenthau to make a "safe and sane" speech in New York. He kept hoping against hope that business would pick up.

Even Marriner S. Eccles, head of the Federal Reserve System, is not satisfied with the spending program, for several reasons. It should have been started sooner, he thinks, should be accompanied by other moves to restore confidence.

But it may be figured from now on, unless there should be some totally unexpected developments, that the President is going to have a tough time with Congress. It is not so much that this body has suddenly developed a power complex, though that would be an easy way to describe it, as that the individual members are looking out for No. 1, and looking out for No. 1 no longer seems to require voting with the President, right or wrong.

Making the Interview Count

Five rules for best results in selecting men for supervisory jobs: 1. Don't ask direct questions. 2. Get the man to talk. 3. Put him at ease. 4. Take time. 5. Keep personal bias out

ROBERT N. McMURRY, Ph.D.
Executive Secretary
The Psychological Corporation, Chicago

SUCCESS as an executive is due as much to personality make-up as to technical ability. This fact is often overlooked in choosing men for supervisory and managerial positions. All too frequently knowledge of the details of the work or specialized training in it are considered as the sole requirements. It is forgotten that to lead, an executive must be able to enlist the cooperation of his subordinates. Employees are, after all, human beings and many of their attitudes toward their work and the company are only a reflection of their feelings toward their superiors. The boss symbolizes the company. If he is unreasonable, undependable, a martinet, or a weakling, no amount of technical knowledge on his part will be likely to make them loyal or cooperative.

Because of the large number of variables encountered in judging an individual's personality make-up, it is not practicable to develop any simple, quasi-automatic procedures, comparable to an intelligence test, which may be expected satisfactorily to eliminate the undesirable. Psychological measures such as those of intelligence, interests, aptitudes, and emotional adjustment provide valuable supplementary information. They must, however, be supplemented and their findings integrated into a picture of the individual as a whole by a careful study of the man's personality make-up. As this must be done individually, it can best be done by means of an interview.

Direct Questions No Help

In the development of an interview procedure to evaluate a man's personality make-up, several considerations must be kept in mind. The first of these is that little of the information desired can be obtained by direct questions. It is obviously futile to ask a man outright whether he has a balanced personality or is free from infantile traits. In every case an affirmative answer will be obtained. In most instances the individual honestly believes that he is a well-balanced and adult person. Even if he does not, which is a very rare circumstance, the fact that he is applying for a position or a promotion gives him strong motivation to conceal his suspicions.

In consequence, any judgments concerning a man's make-up must be made inductively on the basis of the maximum amount of information about him that can be obtained by the interviewer.

To get the maximum information from a person about himself, he must be encouraged to talk. This is a second point of great importance in developing an interview procedure. *Too many interviewers do too much talking themselves.* About the only source of information about a person is what he is willing to tell. If, for any reason, he is unwilling to talk or is prevented from doing so, the effectiveness of the entire procedure is jeopardized. It is too much to expect

STANDARDIZED INTERVIEW RECORD FORM

Applicant's Name_____Date_____Off._____

Address_____Tele._____

Interviewed by_____Class_____

1. WORK HISTORY:

A. Does he appear to have liked his work? Yes_____ No _____
B. Did he show stability on the job? Yes_____ No _____
C. Has he made progress in his work? Yes_____ No _____
D. Did he get his own jobs? Yes_____ No _____
E. What were his relations with his associates? Good____ Poor____
F. What were his relations with his superiors? Good____ Poor____
G. Does he appear to have had adequate technical training? Yes_____ No_____
H. Will his previous work experience be of direct value to him in this work? Yes_____ No_____
I. Has he given evidence of unusual initiative, willingness to accept extra responsibility, or to handle especially difficult or unpleasant jobs? Yes_____ No_____
J. Were his reasons for leaving previous positions apparently justifiable ones? Yes_____ No_____

2. AIMS IN LIFE: ...

A. Does he really appear to want to work? Yes_____ No_____
B. What is his attitude toward the job he is now seeking?
Disinterested____Doubtful about some features____moderately interested____
Anxious to get job____
C. What about this work appeals to him?
I. Opportunity for advancement? Extremely____Moderately____Not at all____
II. Opportunity to make money? Extremely____Moderately____Not at all____
III. Opportunity to get special training or experience? Extremely____Moderately____Not at all____
IV. Prestige of organization? Extremely____Moderately____Not at all____
V. Other features_____
D. How ambitious does he appear to be? Extremely____Moderately____Not at all____
E. Do his ambitions exceed his capacity to realize them? Yes____ No____
F. Has he any especially strong reason to wish to succeed? (Write in)_____
_____
G. Are his aims in life immediate and trivial?(e.g.a ball game) or long run (e.g. preparation for a better job). Immediate_____Long Run_____

3. SOCIAL ADJUSTMENTS:

A. What is his attitude toward people in general? Friendly____Withdrawn____ Antagonistic____
B. Has he given any evidences of Leadership qualities? Yes_____ No_____
C. Has he any unusually strong prejudices? (religious, political, racial, social,etc.) Yes_____ No_____
D. Would these prejudices interfere with his acceptance by his associates? Yes_____ No_____

E. Is his social life adapted to proper work? Yes_____ No _____
F. Has he full or part time work which he wishes to continue? Yes_____ No_____

4. FAMILY AND DOMESTIC SITUATION:
A. Did his family train him to form habits of industry? (jobs after school and during vacation - necessity of earning spending money) Yes_____ No_____
B. Are there evidences of spoiling or pampering by members of his family? Yes_____ No_____
C. Are there any suggestions that his home life was not congenial? Yes_____ No_____
D. Are there relatives living in the home? Yes_____ No_____
E. Does he think they would be favorable to this work? Yes_____ No_____
F. Does he feel that his wife would be favorable to this work? Yes_____ No_____
G. Is his wife working? Yes_____ Part-time____No_____
H. If she is employed, is he anxious to have her quit? Yes_____ Doesn't care___ No___
I. Has he other dependents than his wife? Yes_____ No_____
J. Has he other sources of income besides his own efforts? Yes_____ No_____

5. ANALYSIS OF MOTIVATION:

Think over what the man has said and try to analyze his motives for wishing to take the job. Some of his motives will be favorable to his success; others unfavorable. Below are shown some of the more common favorable and unfavorable motives, and also several negative influences. Check the ones that you believe he has.

Favorable Motives	Unfavorable Motives
1. Need to support dependents_____	1. Childish wish to try job_____
2. Extreme ambition and drive_____	2. Pushed into application by wife, parents, or relatives_____
3. Anxious for opportunity to advance in company_____	3. Looking for something easy_____
4. Strong wish to make money_____	4. Wants to try and see if he likes job_____
5. Special motives:	
a. Wish to marry_____	
b. Wish to prove his abilities_____	

Negative Influences

1. No dependents___ 3. Spoiled, pampered or weak_____
2. No need to earn money____ 4. Family or domestic disapproval of work _____
(Employed wife, living with family)

6. RATINGS ON GENERAL CHARACTERISTICS:

A. Appearance			
1. Cleanliness	Good_____	Average_____	Poor _____
2. Neatness	Good_____	Average_____	Poor _____
3. Appropriateness of dress	Good_____	Average_____	Poor _____
B. Voice	Good_____	Average_____	Poor_____
C. Fluency	Inadequate_____	Adequate_____	Poor_____
D. Ability to organize and present his ideas.			
1. Can he keep on track?			Yes_____No_____
2. Does he present his ideas clearly?			Yes_____No_____
3. Is his presentation systematic and well organized?			Yes_____No_____

interview. This is the fourth point to be kept in mind. Some personnel workers believe that three minutes is an adequate period in which to size up a man. Actually, this is only long enough to mobilize the interviewer's own prejudices. No valid conclusions about a candidate's personality make-up can be drawn from an interview of less than half an hour in length. The first reason that a fairly long period is required is that it takes time to break down a man's reserve in talking to a stranger. Second, a warming-up period is necessary before a man's ideas about even such an intimate topic as himself begin to flow freely.

Probably the most important single factor in insuring a successful diagnosis of an individual's personality make-up is the elimination or, at least, reduction of personal bias on the part of the interviewer. This is point number five. Nearly everyone has his prejudices and biases. Many of these are not even clearly conscious. Nevertheless, they may affect the objectivity of an interviewer's judgment. If he believes that girls who roll their hose are bound to be immoral or that all men who can look him in the eye are honest, his diagnosis of their characters is likely to be correspondingly unreliable.

Because under practical field conditions it is almost impossible to obtain un-

(Continued on page 130)

him always to tell the truth, but even that is of secondary importance, because if a person talks enough he usually reveals himself sooner or later.

About 85 per cent of those to be interviewed will talk freely if put at their ease. This latter factor is the third important element to be considered in developing a successful interview program. If the interviewer is arbitrary or discourteous, the man may be put on the defensive. In an interview of this sort it is not advisable for the official in charge to attempt to impress the applicant or candidate with his importance.

Friendly and Informal

If, on the other hand, the atmosphere is friendly and somewhat informal and conducted without any third parties listening in, the man may be encouraged to speak freely and give voluminous information about himself. He is talking about his favorite topic, himself, and when he has a sympathetic audience it is usually an irresistible temptation for him to speak at great length.

Time is of the essence of a successful

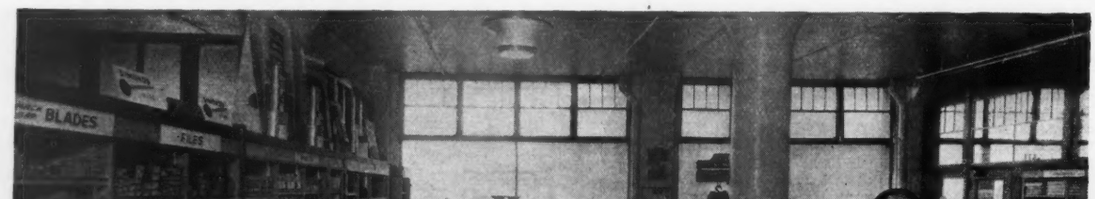
E. Intelligence, insight, open-mindedness.
1. Does he "get the point" quickly? Yes_____ No_____
2. Are his questions intelligent? Yes_____ No_____
3. Does he show a reasonable understanding of significant happenings in business and social life? Yes_____ No_____
4. Has he apparently some insight into his own qualifications and limitations? Yes_____ No_____
5. Does he appear open-minded toward new ideas and points of view? Yes_____ No_____
6. Does he appear capable of learning this work? Yes_____ No_____

F. Morale, self-confidence.
1. Have his past experiences broken his morale? Yes_____ No_____
2. Will he rise to a challenge and show strong fighting spirit? Yes_____ No_____

G. Judgment, Common-sense.
1. Has he been inclined to embark on wild, impractical projects or schemes? Yes_____ No_____
2. Is his thinking realistic rather than wishful? Yes_____ No_____
3. Has he any unusual or radical ideas or theories? Yes_____ No_____

H. Adjustment.
1. Has he any mannerisms or peculiarities of appearance or action which might interfere with his acceptance by his associates or others? Yes_____ No_____
2. Will he probably be able to gain the respect and confidence of his associates? Yes_____ No_____

I. Personality traits.
Does he have any of the following traits to more than average degree?
1. Withdrawn, shy, seclusive? Yes_____ No_____
2. Disinterested, casual, given to lapses of attention? Yes_____ No_____
3. Aggressively friendly? Yes_____ No_____
4. Inclined to be defensive? Did he begin to cross-examine the interviewer? Yes_____ No_____
5. Boastful? Yes_____ No_____
6. Egotistical, self-centered, over-rates his abilities? Yes_____ No_____
7. Has a sense of humor? Yes_____ No_____
8. Weak, mild, submissive? Yes_____ No_____
9. Energetic, enthusiastic? Yes_____ No_____



Let the Specialist Carry Your Stock

AN EDITORIAL

THE MEN who gather at the 37th annual Triple Mill Supply convention in Pittsburgh, May 9, 10, and 11, have profoundly influenced the buying habits of industry. In plain fact, they have by good salesmanship and tireless service virtually wrought a revolution in industrial purchasing and stock-keeping practices—the kind of revolution that hurts no one, works to the benefit of everyone concerned.

Not so many years ago many, perhaps most, plants literally boasted of well-filled storerooms—of bins and shelves and racks loaded with every kind of supply item likely to be needed. Often there was overstocking, invariably serious depreciation, and the carrying of many items that never would be called for.

Reason, if not complete justification, for such conditions lay in the circumstance that transportation was slow and sources of supply often remote. Then, too, sharp-penciled accountants did not always stop to figure the cost of keeping such stocks in terms of interest charges, insurance, floor space tied up, depreciation, and frozen capital.

Today smart managers realize that no plant is so profitable or rich that it can afford to carry much more than an emergency stock of the countless supply items it needs. A telephone call or wire gives them access to complete stocks of any needed items; express trains, fast trucks, airplanes, reduce miles to minutes in bringing these items to their plants. And they know, also, that behind these stocks and transportation facilities there are trained and efficient distributor organizations that are anxious, and know how, to serve alike in the day's routine and in emergencies.

Thus it has come about that cost-minded operators let the stock-carrying specialist carry their supply stocks, while they put their capital to work producing goods and paying wages.

Right now one of industry's most pressing problems is how to find employment for more people. Much of the answer lies in keeping costs down and capital liquid.

The mill supply distributor can help any plant to do these essential things.

EDITORIALS

Two More Decisions Show Up Labor Act

When an agreement is reached with labor, you must sign a contract, the National Labor Relations Board said last month to employers in the Inland Steel case. That was to be expected. The Labor Board is charged with administering the law. The law was intended to promote the organization of labor.

There is little to object to in a decision to the effect that responsible parties contracting in good faith should put their agreement in writing. But there was considerable question as to the responsibility of the labor party in the Inland Steel case, which makes it surprising indeed for the Labor Board to declare:

"An employer is not privileged to deny collective bargaining to the representatives of his employees merely because he views the representatives as irresponsible, and the alleged irresponsibility is likewise irrelevant in determining whether he must embody understandings in a written agreement."

This ruling is so obviously bad that it needs no further comment.

The decision in the Republic Steel case, rendered a few days after the Inland case, is another decision that gives us pause. The strike is not so far in the background but that we remember the unjustified violence on the part of the strikers, including the use of explosives and obstructing the United States mails. It seems extraordinary that the Board should exclude from re-employment only seven of the men involved.

That the Republic Steel Company was responsible for conflict between strikers and law-enforcement groups also appears to us to be a peculiar decision. Surely it must be considered as by their own volition that law-enforcement officers decide to interfere or refrain from interfering in specific situations resulting from industrial conflict.

If there is any bright side to the Inland and Republic decisions it is that the Labor Board itself has taken two more steps to bring about what Senator Burke sought but could not get, namely, an investigation of the Board. Public opinion, if goaded far enough, will again react as it did at the time of the strikes when it said quite plainly, "You have gone too far."

Like every other discussion of the Labor Law and the Labor Board, this one gets us back to the law itself, and the need for amendment. We still are of the opinion that the best interests of all concerned would be served if Congress amended the law to incorporate the proposals made by the Business Advisory Council:

1. Employees must be free to organize and bargain collectively without interference from any source.

2. The Labor Board must not favor any particular form of labor organization.

3. Employers as well as employees must have the right to invoke the services of the Board.

4. The Board and its trial examiners must not combine fact-finding, prosecuting, and judicial functions.

5. Rights and obligations of employers and employees must be more clearly defined in the Act and made less subject to definition at the discretion of the Labor Board.

Nor This Wage and Hour Bill Either

Wage and hour legislation is up again. Let us hope that it will not be enacted. Even a good bill could do nothing but add to confusion if passed at this time. Freedom from innovations, from social experiments, is what is needed in the interest of recovery. Such freedom, added to tax sanity and Congressional independence, will be the best medicine for the country.

The present draft, approved by the House Labor Committee, like the predecessor bill, which was killed by the House, aims at 40 cents and 40 hours. Its administration would be in the hands of the Secretary of Labor. Enforcement would be by the Department of Justice and other law-enforcement agencies. A minimum of 25 cents would increase to 40 cents in three years. A maximum of 44 hours would decrease to 40 hours in two years. The act would apply to industrial units engaged in interstate commerce, decision to be made by the Secretary of Labor.

Maybe wage and hour legislation is needed to stop chiseling, to provide living wages, to distribute wealth. But nobody knows that to be true. Nobody knows how many wage earners would be affected, to what extent industry would be disrupted. No survey has been made. There is not even a predetermination of what constitutes "an industry."

For a long time natural economic law apparently has seen to it that wage earners receive an average of 41 per cent of the value added to raw materials by manufacture. If that percentage represents the value of the services rendered production by wage earners, then minimums will do nothing but bring about a shifting of amounts in individual wage-earner pay envelopes.

The whole matter should be studied. Legislation, if any, should be based on the conclusions of an extensive survey. When, and if, legislation is enacted, it should be put into effect during a period of prosperity, not while industry has the jitters.

Saves Time and Money to Set Rates the Graphic Way

Why take time studies over and over? If this graphic method of setting rates works on plating and finishing operations on silver hollow ware, and in a toolmaker's grinding room, why shouldn't it work for you?

R. S. PHILBRICK
Industrial Engineer

FEW TIME-STUDY departments take full advantage of the graph system of setting piecework rates. And the few that do, go only as far as similar pieces when they could, just as well as not, apply the same method to similar operations. In sixteen years' experience with time study, I have never seen an operation that couldn't be recorded by graph. Yet there are time-study departments that are still going through the rigorous routine of taking studies on the same operation over and over again.

One objection to piecework is the high cost of running the time-study department. In addition, there are the excessive costs of lots too small to be time-studied, the pieces in a lot that are finished before a rate can be set, and the inaccuracy of setting rates by comparison. Put them all together and they are sound arguments for the graphic method I am about to describe.

To illustrate how operations can be recorded by graph, and how the graphs are then used to set rates, I have selected an installation made a year or so ago in the plant of Reed & Barton, silversmiths, of Taunton, Mass.

The item manufactured is silver hollow ware. The finishing department was the first one in which the system was set up. Lot sizes ranged from one to twelve pieces, and the pieces were in no way similar. They included teapots, sugar bowls, candlesticks, etc. Any three of six finishing operations could be used. Area, as used by the plating department to compute the silver deposit, was used as the basis for recording the times on the graph.

From several time studies, the characteristics of the different items were then computed in per cent of time. Results of the analysis are shown in Figure 1. To obtain the piecework price of any piece, a straight-edge is placed on the graph at the area. The value is then read at the intersection of the line that represents the desired finish.

This value, plus or minus the percentage of the characteristics, gives the piecework rate. There are two sets of lines on the graph, curved ones for areas under 1 sq.ft., straight ones for areas greater than 1 sq.ft.

For example, suppose we take a vase with an area of 3½ sq.ft. and an attached base and white inside (not buffed). By laying the straight-edge at 3½ we find that the value of the C.D. & Butler operation is 10.3 cents. From the characteristics we find that the sum of the attached base and the white inside is minus 35 per cent. Then 10.3 — 35% = 6.7 cents. Prices on other operations may then be read directly by laying the straight-edge on the C.D. & Butler line at 6.7 and noting the values at the various intersections.

Similarly for Sterling

Sterling hollow ware is handled in practically the same way, except that weight and gauge, instead of area, are used as the base.

Next, the system was installed in the plating department. The entire operation was first broken down into units, first to simplify the analysis, second to compute the labor used, as shown in Figure 2.

Pieces were then placed in three classes: *A*, dish-shaped pieces; *B*, bowl-shaped pieces; *C*, pot-shaped pieces which require inside plating.

Results of the analysis are shown in Figure 3. The three orange lines represent Unit *A* operations on *A*, *B* and *C* classes of work. White represents Unit *B* operations (used for nickel silver pieces only); yellow, Unit *C* (which is the scratch brush operation); red, Unit *D* operations for all three classes of work; and black, Unit *E* operations for Class *C* work.

Just as in the finishing graph (Figure 1), area is used to determine time values, plus or minus characteristics. Values of units are then added to obtain total plating price.

This same system has been successfully used in the grinding department of a tool manufacturer. Metal removed was used as a basis for recording the time of each operation.

Not the least of the many advantages of the foregoing method is that, after the graphs have been set up, the system can be operated and the rates set by a clerk or time-study apprentice.

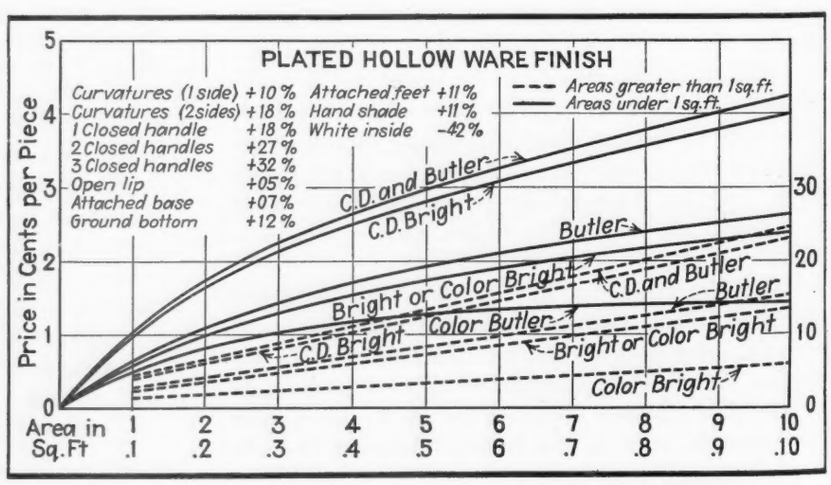


Figure 1. From this chart, values for finishing plated silver hollow ware are read directly and converted into piecework rates

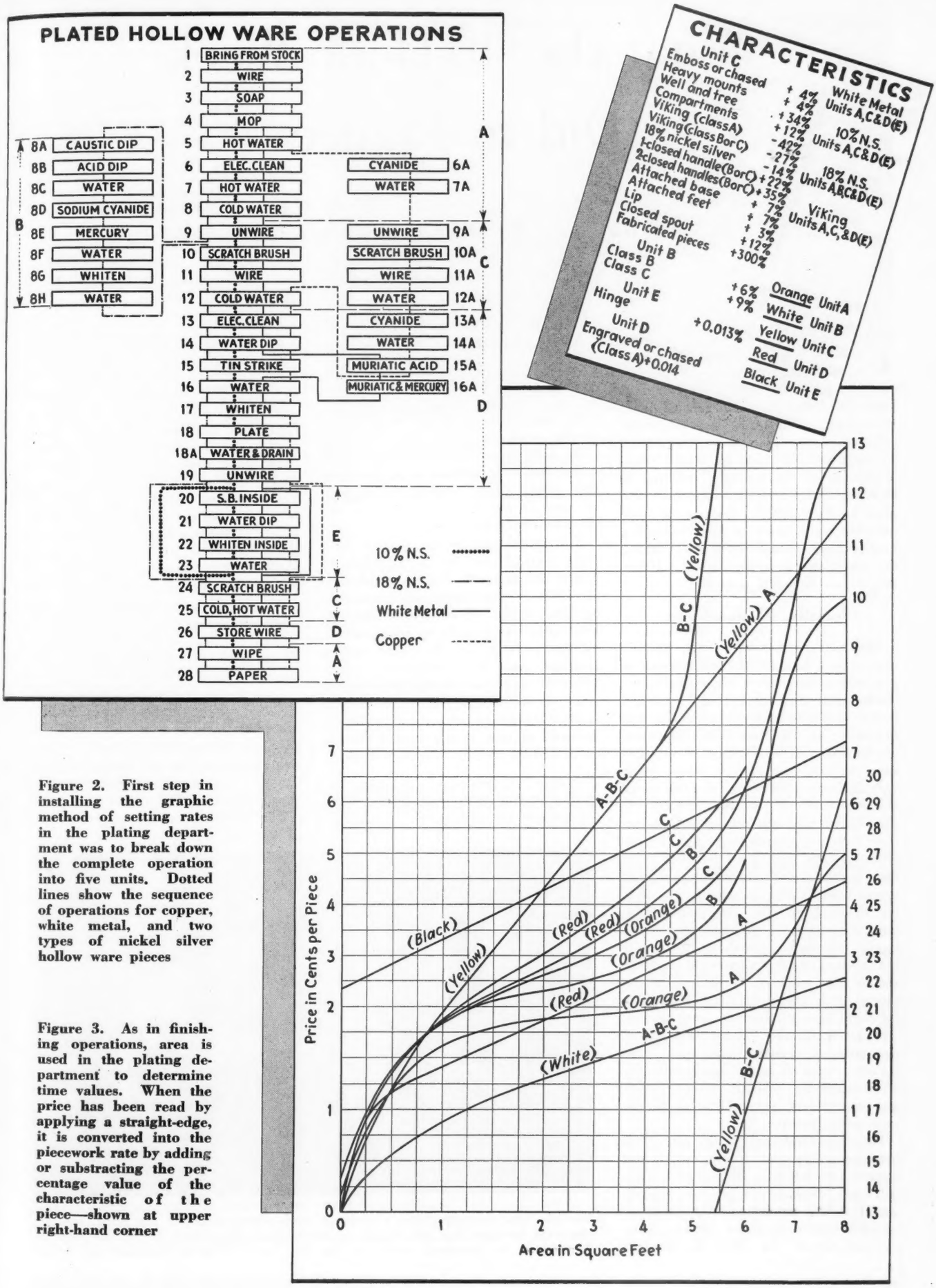


Figure 2. First step in installing the graphic method of setting rates in the plating department was to break down the complete operation into five units. Dotted lines show the sequence of operations for copper, white metal, and two types of nickel silver hollow ware pieces

Figure 3. As in finishing operations, area is used in the plating department to determine time values. When the price has been read by applying a straight-edge, it is converted into the piecework rate by adding or substracting the percentage value of the characteristic of the piece—shown at upper right-hand corner

What the 40-Hour Week Did to France

France, too, has her starry-eyed New Dealers. Their 40-hour week stimulates neither employment nor purchasing power, turns out to be an expensive luxury

R. PH. SCHWARZ
Research International
Paris

FRANCE has now been living long enough with the 40-hour week to warrant our making a first survey of practical results. The basic act of June 21, 1936, provided general legal framework. Numerous decrees-in-council applied the shorter week, industry by industry and trade by trade. Generalization of the measure, initiated in October, 1936, was three-quarters complete by April, 1937. America can conceivably learn much to her everlasting benefit from French experience during the year that has since elapsed. Hence this rather complete analysis.

Socially, Economically

The total number of French workers now subject to the new time schedule is not known, but figures are available for commercial and industrial establishments with 100 hands or more. At the beginning of this year 2,339,421 workers employed in 8,210 places of business were working the shorter week, while only 25 firms, with a total of 4,848 workers, continued on the old schedules.

Socially, the measure aimed to reduce "cyclical" unemployment. In addition it was considered a relief from the "technological" unemployment that would possibly have subsisted even after an upswing of the business pendulum. *Economically*, national purchasing power was to be stimulated by restoring normal wage incomes to a large section of workers heretofore unemployed and whose dole did not allow for more than a minimum consumption.

Agitation for the 40-hour week aimed not only at reducing the legal time schedule from 48 to 40 hours, but also at maintaining 48-hour wages. This was tantamount to seeking a 20 per cent wage increase.

On the employers' side, objections centered on the rise in costs, which was expected to follow a 20 per cent wage increase. Such a rise, it was argued, would entail an advance in prices—which would reduce, not increase, purchasing power. In 1933, M. Maurice Pinot studied the probable effect of the shorter week on prices. In his book, "The Forty-Hour Week, Unemployment, and Prices," he showed that the price rise would range somewhere between 10 and 18 per cent according to the industry concerned.

The actual rise in the general price level worked out at a considerably higher percentage.* For, in actual fact, the 40-hour week was not allowed to operate singly. Even before the 40-hour week was actually enforced, labor's political victory in the 1936 spring elections gave it a bargaining power which it had lost during the depression. It could not be expected that such a weapon would remain unused. In point of fact, it *was* used to secure an immediate step-up of hourly wages.

During the depression, hourly cash wages had gone down by approximately 6 per cent from their 1930 high (Paris figures). But, in terms of purchasing power, they had increased by approximately 17 per cent. However, actual weekly earnings were greatly reduced since short time was widely practised during this period. Also, from August, 1935, onwards, the slow but steady rise in cost of living afforded some justification for higher wages. Between that month and May, 1936, the cost of living index went up by about 6 per cent and the retail index by nearly 10 per cent.

As against these percentages, the first post-election wage rise—which might be termed political—averaged from 12 to 15 per cent. It benefited mainly manual labor paid by the hour.

This was only the beginning. From the cost angle, higher wages had an immediate incidence on social insurance premiums since the premium represents a given percentage of wages—in 1936, 3½ per cent for employer and worker; since January, 1937, 4 per cent each.

The Paid Vacation Act added an-

* Rise in the wholesale price index between May, 1936, and March, 1938, equaled 62 per cent; rise in the (Paris) retail index between the same dates, 50 per cent.

Packing motion-picture film in the Kodak-Pathé plant at Vincennes, near Paris

French wage earners, with a 40-hour week, earn more by the hour, less by the week because they are largely on short time. Since they live by the year, in France as in America, result so far has been a lower standard of living

other cost factor. It has generally been estimated to represent 4 per cent of the annual payroll; 3 per cent would probably be nearer the truth. This act enforced a guaranteed maximum of 12 working days of paid vacations for workers continuously employed with the same firm for at least one year, and a minimum of 6 days for those whose employment with the same firm covered at least 6 months.

For white-collar and other workers paid by the month, the measure was in no way an innovation. Most of them had been enjoying paid vacations. Besides, a fair proportion of workers do not qualify for paid vacations on the maximum basis because they do not fulfill the condition of one year's continuous employment, and another section does not even qualify for the 6-day minimum. It is for these reasons that the added cost is nearer 3 than 4 per cent.

Thus there were three new cost factors, the "political" wage rise, higher insurance premiums, and the cost of paid vacations. On the above basis a salary of 103.5 in May, 1936 (basic salary = 100; social insurance premium = 3.5), rose to about 116, and the increase in wage costs, even prior to the enforcement of the shorter week, was over 12 per cent.

Last, the devaluation of the franc (Sept. 26, 1936) inflated the price level still further. This fourth factor, too, operated prior to the enforcement of the 40-hour week.

A 20 Per Cent Rise

The coincidence in time and the associated action of all three elements makes it difficult to single out the specific effects of the 40-hour work week. Taking the cost level reached a few days after devaluation, it can be said with some degree of certainty, however, that the shorter week caused a rise in hourly wages of 20 per cent.

Has there been any restraining factor that would offset the effects of higher costs? Greater efficiency of labor, higher mechanization, for instance?

Since the beginning of the French New Deal, alleged changes in labor efficiency have been a matter of controversy. In many quarters it has been held that the new social policy has adversely affected output per hour, hence output per working day. But any talk of wholesale reduction in labor efficiency must be carefully scrutinized, for when it comes to a question of figures versus feeling, reliable information is exceedingly scarce. One notable exception is the coal mining industry, where legal working time is now 38 hours 40 minutes per week. The 1935 yearly average output was 1,332 kilos per miner per day; it was only 1,234 kilos in 1937.

Assembly floor in the shops of Messrs. Call at Denain

France can ill afford the luxury of the 40-hour week. Its grave disadvantages are by no means offset by somewhat nebulous benefits—the incentive it provides for mechanization and technological improvement, and its effect upon public health

TABLE I. DROP IN OUTPUT

Industries	*Private Source**	*Government Inquiry (December, 1937)*
Silk, hosiery, spinning	0 to 10%	No data
Woodworking	10%	" "
Ceramic	10 to 23%	" "
Metal-working	0 to 20%	A few cases
Glass	0%	No data
Macaroni, etc	5 to 18%	" "
Biscuit	0 to 15%	" "
Textiles	See above, first item	Occasional improvements
Clothing	No data	No reduction
Leather	" "	No variation
Shoes	" "	" "
Shipbuilding	" "	No reduction
Metallurgical and mechanical	See metal-working	Reduction due to new help
Building	No data	Employers claim reduction

* *L'Europe Nouvelle*

As to other industries, two reports have been published, one of which, from a private source (*L'Europe Nouvelle*), bears evidence of a considerable drop in labor efficiency. The other, taken from the government's official inquiry into production, is less unfavorable. See Table I. Unfortunately, with one or two exceptions the two sets of data do not bear on the same industries.

To what extent has it been possible to offset the drop in labor efficiency? The only figures available have been collected by private inquiry. See Table II.

A personal inquiry, with various efficiency experts, has led us to believe that, in the metal trades at least, the recovery in weekly output has been considerably greater than shown above.

In one case, through internal reorganization, a foundry was able to maintain its former output regardless of the shorter week and without any increase in personnel. In a chain and transmission gear factory, thanks to new equipment installed, the weekly output is now bigger than it used to be under the 48-hour week. In a petroleum refinery, the whole loss of weekly output due to the shorter week was recovered through reorganization, and the increase in personnel was limited to 5 per cent.

Much new equipment seems to have been installed under the pressure of the new working conditions. But increased mechanization has been hampered by two factors—first, political uncertainties confronting the employer position, hence hesitancy of capital in

TABLE II. RECOVERY OF LOSS IN OUTPUT

Industries	*Through new equipment*	*Through improved organization*
Silk	0	0
Woodworking	0	0
Ceramic	1 to 1.5%	0
Metal-working	0 to 15%	0 to 12%
Glass	0 to 50% (*average, 8.3 X*)	0 to 50% (*average 6.6%*)
Macaroni, etc	0 to 20%	0 to 30%
Biscuit	1 to 9%	0 to 1%

Source: L'Europe Nouvelle

making new investments; second, shortage of available funds coupled with the high cost of bank credits. Just at a time when funds were most required for the financing of capital investment, three claims were simultaneously laid against them through higher wages, a higher general price level, and costlier social security.

New capital investment has therefore been confined to firms with an A-1 financial standing. Yet machine tool imports show a definite increase over the last couple of years. They confirm the trend towards greater mechanization.

It will be recalled that the two main purposes of the 40-hour week were the reduction of unemployment and the increase in national purchasing power.

From figures available it is evident that the 40-hour week has not proved a radical cure for unemployment. In 1936 the number of subsidized unemployed was, it is true, noticeably lower than in 1935, but a similar comparison between 1937-38 and 1936-37 shows that the earlier rate of progress has by no means been maintained.

Statistics show that workers in medium- and large-sized establishments numbered 2,339,421 on January 1, 1938, against 2,157,170 a year earlier, the difference of 182,251 representing an increase of 8.4 per cent. Had the shorter week led to the full theoretical extent of re-employment, the number of workers in employment should have increased 20 per cent.

Considering that a large number of French factories had been working less than 48 hours (even before they were legally compelled to do so), the actual percentage of increase should have been somewhere between 13 and 16 per cent. Thus, the actual figure of 8.4 per cent is small. *It vanishes altogether if one remembers that in the meantime the period of military service was lengthened from one year to two years and that school-leaving age was raised from 13 to 14.*

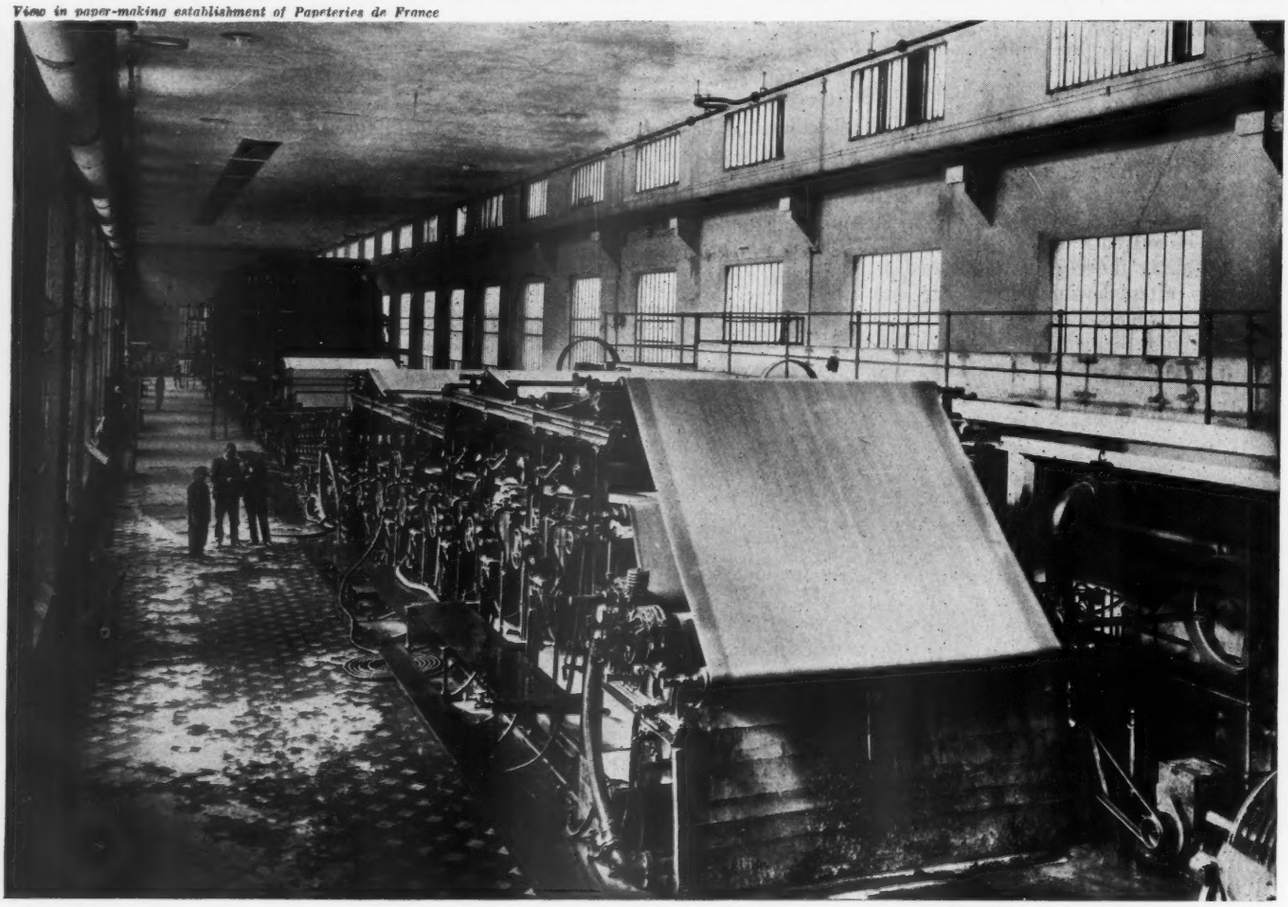
If both these factors are taken into account, not only is there no genuine reduction of unemployment, but there is an actual increase. The combined effect of these two measures is to withhold from the labor market a yearly influx of somewhere in the neighborhood of 250,000 to 300,000 workers.

After one year's application of the shorter week, there is now, all told, less

(Continued on page 136)

France's increase of 8.4 per cent in total number of workers vanishes when one considers that the period of military service has been lengthened from one year to two years, and that school-leaving age has been increased from 13 years to 14 years. Combined effect has been to withhold a yearly influx of 250,000 workers from the French labor market

View in paper-making establishment of Papeteries de France



Better Painting Costs Less

Because careful selection and application of the material, with proper scheduling and handling of work, result in jobs that look better, last longer

FREDERIC OAKHILL
Plant Engineer
Bauer & Black Division
of the Kendall Company, Chicago

PAINT is such a commonplace and widely used material that plant operating men frequently fail to realize that, in order to get the most out of it for the least cost, a thorough understanding of certain fundamental facts is required.

Functions of paint from the industrial standpoint are, in the order of their importance:

1. To protect surfaces from atmospheric elements and fumes which tend to cause corrosion or deterioration.

2. To enhance the appearance of a structure and promote sanitation.

3. To create a more pleasant workplace and help promote good housekeeping.

4. To create harmonious color combinations, which seem to lessen fatigue and increase efficiency.

5. To increase the light-reflective properties of surfaces. This enhancement of reflection tends to reduce the amount of artificial illumination needed for proper industrial plant lighting.

10 Rules for Painting

Protection of a structure from atmospheric elements is of prime importance. Each type of surface and exposure requires special consideration, which is best handled by consulting the manufacturers of the paint and following their recommendations. However, there are some generally accepted rules which should be familiar to all persons responsible for painting work. These rules are:

1. Use paint made by a reliable manufacturer, who has sufficient resources to cooperate in the solution of special problems.

2. Recognize the fact that technical advances are constantly being made in the production of paint; normally a better product is available each year.

3. Study the conditions under which paint is to be used; if necessary make tests to assure use of best material.

4. Be sure that the surface to be painted has been properly prepared and that the paint itself is properly applied under favorable conditions.

5. Under most conditions a prepared paint is more desirable for industrial use than one that is mixed on the job.

6. See that the paint possesses these characteristics: (*a*) Good surface coverage per gallon; (*b*) produces a finished surface that is neither too hard nor too soft; (*c*) life of the material such as to make its use economical, usually three to six years; (*d*) good color retention; (*e*) leaves a surface suitable for repainting.

7. Before applying make sure that the paint has the correct consistency; that it is well brushed out (or evenly sprayed) on the surface; that sufficient drying time is allowed between coats.

8. Make the succession of coats such that the first gives a good sealing and priming effect and has a surface finish or tooth that will insure good adherence of the next coat. Select carefully the proper undercoating material for the various types of surfaces, such as wood, plaster, concrete, brick, and metal.

9. Remember that peeling is the most common failure due to improper application of paint. Peeling may be prevented by being sure that the surface to be painted is not damp, exposed to freezing weather conditions, greasy, or primed with an ochre-pigmented material. Also, if the surface is wood, see that all fatty and resinous spots are properly sealed. Take care that the undercoater is not a too-glossy material; the foundation coat should have a finish with sufficient tooth to promote adherence of the next coat of paint. However, successive coats of porous paints, such as the so-called flats should not be used as an undercoat or as successive coat over coat.

10. Take care in adding driers, thinners, and oils to paint; the recommendations of the manufacturer should be followed. Chemical properties of the pigments and vehicles in paint determine what may be added without destroying the value of the material.

Use of paint and color to improve the appearance of a structure is recognized, but the psychological effect of bright and colorful surroundings has not always been fully appreciated.

A bright, well-painted workplace tends to induce operators to keep their surroundings neat and clean. Better housekeeping in turn tends to increase the safety consciousness of the workers. When colors are used in harmonious combinations the psychological effect is to increase morale and efficiency.

Color may be used to cause an area to appear large or small, warm or cold, cheerful or sobering, or to indicate the nature of the occupancy.

The first step is to select a color scheme that will harmonize with the function of the room. Light colors make a room seem larger; dark colors make it appear smaller. Colors of strong intensity should be used only in small areas; those of mild intensity may be used in the larger rooms. A good rule to follow is to copy nature herself, using darker shades for the floor, with lighter shades as the colors go upward, the ceiling of the room being in the lightest tint of all.

Paint and Light

Well-planned painting results in increased illumination. Walls and ceilings painted white or a light tint in a semi-gloss or eggshell finish have greater reflection value than if painted in darker shades of color. Under some conditions a paint with a gloss finish is preferred, even though it has a high reflective value with regard to glare. The cost of maintenance (washing) of such an area and the lighting fixtures in it is more than compensated for by the direct saving in the cost of artificial illumination and those intangible savings caused by the cheerful appearance of the surroundings.

The technical phases of paints and painting are many and merit more thorough study than is possible in an

BAUER AND BLACK

DIVISION OF THE KENDALL COMPANY
CHICAGO, ILLINOIS

PLANT PAINTING STANDARD COLOR CHART

MISCELLANEOUS SUPPLIES

TURPENTINE	Regular paint practice usage
OLEUM SPIRITS	Turpentine substitute
BOILED LINSEED OIL	Regular paint practice usage
FLATTING OIL	Vehicle ingredient of aluminum paint
GLAZING LIQUID	Adding higher gloss to paints and to give greater durability
JAPAN DRYER	Regular paint practice usage and gold leaf size
ORANGE SHELLAC	All normal uses and as a primer and sealer for wooden surfaces
WHITE SHELLAC	All normal uses and as a primer and sealer for wooden surfaces
WALL PRIMER AND SEALER	Primer and sealer for new or exposed old plaster, concrete or brick surfaces
ALUMINUM FLAKES	Pigment for aluminum paint-vehicle to be chosen to meet the requirements of the surface to be finished
VARNISH REMOVER	Normally for removing old paint and varnish from surfaces to be refinished
UTILITY VARNISH	Interior surfaces not requiring a hard or durable finish
HARD SURFACE VARNISH	Exterior surfaces, signs, and other surfaces requiring a hard durable finish
WOOD STAINS	LIGHT OAK-MAHOGANY OAK-NATURAL-WALNUT
TRAFFIC MARKING	All aisles and burden center areas to be defined by 2" white band marking painted on floor

- White-eggshell — Factory and warehouse ceilings and walls
- White-gloss — As above except where a gloss is req'd., also table tops, miscellaneous cabinets, lavatory equipment and such items where white is desirable
- Gray-gloss — Factory and warehouse dados, 54" high, also miscellaneous items as shaft hangers, table legs, tool and stock cabinets, shelving and stair risers. Merchandise, warehouse & departmental trucks
- Ivory-eggshell — Kendall Standard Office ceilings
- Cream-eggshell — Office walls
- Brown-gloss — Kendall Standard Office dado-40" high
- Brown-trim-gloss — Kendall Standard Office door and window trim, also for cabinets, shelving, etc., when not practical to use the standard office furniture color
- Green-eggshell — Office ceilings
- Green-eggshell — Office walls
- Green-gloss — Office dado-40" high
- Green-trim-gloss — Office door and window trim, also for cabinets, shelving etc. when not practical to use the standard office furniture color

- Machinery-green — Machinery and machine equipment
- Handrail black — Interior handrails, hand-guards, electric motors, controllers and switch boxes. Janitor trucks
- Fire equip. red — Fire fighting equipment
- Metal primer — Exposed metal surfaces except galvanized iron. Galvanized iron to be washed with a copper sulphate solution & primed in the usual manner
- Outside black — All exterior metal surfaces
- Outside red — All exterior wood and masonry surfaces
- Barrett's eternium — Acid and alKali resistant paint Bleachery basement piping and tanks and similar surfaces Use Barrett's thinner
- Office furniture green — Office metal furniture and fixtures, also wooden furniture and fixtures where desired
- Office furniture oak — Office wooden furniture and fixtures
- Aluminum — Radiation, steam boiler, hot piping and tanks, refrigerating system piping and tanks, piping in boiler and generator room paint sealer. Also for surfaces not practical to cover with oil paint
- Floor dressing and preservative — Ingredients used: ¼ gal. stain and ½ pint flatting oil to gal. Pratt and Lamberl's OKene

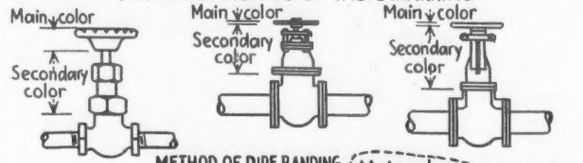
IDENTIFICATION OF PIPING

All piping except as noted to be painted the same color as the adjacent surface, and to be marked at walls, ceilings, valves, or intervals for identification

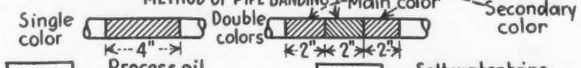
AMERICAN STANDARDS ASSOC. SCHEME FOR IDENTIFICATION OF PIPING

Class	Colors
F- Fire protection equipment	Red
D- Dangerous materials	Yellow or Orange
S- Safe materials	Green or the acromatic colors, white, black, gray, or aluminum
P- Protective material	Bright blue
V- Extra valuable materials	Deep purple

STANDARD METHOD OF VALVE MARKING



METHOD OF PIPE BANDING



Y	Process oil Yellow	G	Salt water-brine Green
Y B Y	Fuel oil Yellow & black	G R G	Hot water Green & red
Y Blue Y	Gas Yellow & blue	G W G	Cold water Green & white
Y R Y	Acid & alKali Yellow & red	G B G	Refrigerated water Green & black
O	High pressure steam supply - Orange	G Y G	Hydraulic Green & yellow
O B O	High pressure steam return-Orange & black	G A G	Compressed air Green & aluminum
O W O	Low pressure steam supply-heating-Orange & white	G Gold G	Tube carrier Green & gold
O Blue O	Low pressure steam return-Orange & blue	B G B	Salvage water Black & green
P Y P	Freon Purple & yellow	B R B	Waste drain Black & red
P R P	Ammonia Purple & red	G	Electric conduits Gray
R	Fire protection equip.-Red Includes only main runs of piping	ELECTRIC LIGHT & POWER PANEL BOXES PAINTED SAME AS ADJACENT DADO COLOR	

article of this kind. Paint manufacturers are good sources of information.

For greater efficiency and economy in handling plant painting the plant engineer or individual responsible for that work should develop:

1. Plant standard color chart.
2. Schedule of washing and painting of surfaces.
3. Record of work done and costs.
4. Procedure for handling the work.

The form and substance of these guides must obviously be fitted to the conditions and needs of the individual plant. The following suggestions may be helpful in planning the work.

Standard Color Chart

To accomplish its purpose, the standard color chart should contain color samples of all paints used, identified by name, with a list of the places where they are applied, such as walls, ceilings, dadoes, and so on. It should also show the color scheme used for the identification of piping. Our chart contains, in addition, a list of the miscellaneous supplies such as oils, thinners, and driers, with a note as to where or how they are used.

The procedure for handling the painting and maintenance of all painted surfaces throughout the plant, involves the use of:

1. Set of plant floor plans.
2. Plant standard color chart.
3. Estimate—Painting Time and Material Record.
4. Painting Records.
5. Forms for control of work orders.

Before asking for bids from contractors, a complete set of instructions and specifications is drafted so that all persons concerned will be fully informed about the work to be done under the contract, and the conditions under which it is to be performed.

The plant is divided into painting areas, which consist of such items as individual rooms, fire escapes, elevated water tanks, stairwells, elevators, elevator shaftways, and so on.

Each area is given an index number which is noted on a set of floor plan blueprints. This index number is used at all times to identify the area, being painted in some conspicuous location in the area and placed on all records.

Each time an area is repainted the date of completion is noted adjacent to the index number.

Work within any painting area is handled separately from the work in every other area.

MECHANICAL DEPARTMENT
ESTIMATE - PAINTING TIME & MATERIAL RECORD

OPERATION	MAN HOURS
WASHING	
SCRAPING	
PATCHING	
SEALING	
PAINTING	
BRONZING	
VARNISHING	
FROSTING	
GLAZING	
REMOVING	
REFINISHING	
DRESSING	
SANDING	
TRAFFIC-MARKING	
PIPE BANDING	
RETOUCHING	
MISC. PREPAR.	
TOTAL MAN HOURS	

NO.	DESCRIPTION	NO. OF COATS
	CEILING	
	PIPES	
	WALLS	
	COLUMNS	
	WINDOWS	
	DOORS	
	RADIATORS	
	DADO	
	TRIM	
	FLOORS	
	PARTITIONS	
	RAILS	
	MACHINES	
	GUARDS	
	STEPS	
	LOCKERS	
	BENCHES	
	RACKS	
	CABINETS	
	DESKS	
	CHAIRS	
	TABLES	
	TRUCKS	
	SHELVES	

AREA NO.

BLDG. NO. FLOOR NO. APPROX. NO. OF SQUARES IN AREA JOB NO.

DATE STARTED DATE FINISHED

REMARKS

	ESTIMATE	COST RETURNS
LABOR		LABOR
BURDEN		BURDEN
MATERIAL		MATERIAL
TOTAL		TOTAL
MAN HOURS		AUTH. AMT.

APPROX. TOTAL NO. OF SQUARES WORKED

TURPENTINE	1			DRYERS	34			
OLEUM SPIRITS	2			REDUCING OIL	35			
LINSEED OIL	3			GRANOLITH	36			
FLATTING OIL	4			YELLOW	37			
GLAZING LIQUID	5			ORANGE	38			
JAPAN DRYER	6			BLUE	39			
ORANGE SHELLAC	7			PURPLE	40			
WHITE SHELLAC	8			FLOOR ENAMEL				
WALL PRIM. & SEAL.	9			ALCOHOL				
ALUM. FLAKES	10			BENZINE				
VARNISH REMOVER	11			KEROSENE				
UTILITY VARNISH	12			OXALIC ACID				
HARD VARNISH	13			COLORS IN OIL				
EGG SHELL WHITE	14			WOOD FILLER				
GLOSS WHITE	15			STAIN				
DADO GRAY	16			TRAFFIC WHITE				
IVORY CEILING	17			ZINC SULPHATE				
WALL CREAM	18			COPPER SULPHATE				
BROWN DADO	19			STEEL WOOL				
BROWN TRIM	20			SANDPAPER				
CEILING GREEN	21			PLASTER				
WALL GREEN	22			FIBRE PLASTER				
DADO GREEN	23			LIME				
TRIM GREEN	24			OKENE				
MACH. GREEN	25			DETERGENT - SOAP				
HANDRAIL BLACK	26			SAVOGRAN - SOAP				
FIRE EQUIP. RED	27			SPONGES				
METAL PRIMER	28							
OUTSIDE BLACK	29							
OUTSIDE RED	30							
BARRETT'S ETURNIUM	31							
ETURNIUM THIN	32							
FURNITURE GREEN	33							

This form is used in preparing cost estimates for painting and maintenance of painted surfaces

Whenever any major work is done within an area, all pertinent data are noted on the Painting Records card. These cards are filed numerically and kept by the head painter.

All work order estimates are made out in full on the Estimate-Painting Time and Material Record form. The estimate is used in making out a Budget Order and upon its approval the estimate and a Repair Request are returned to the head painter. He keeps all approved estimates on file, filling in all pertinent data as the job progresses. These forms are kept in an 11x8½-in. loose leaf binder in the sequence of their approval.

All materials that are regularly re-

quired are carried in the mechanical department storeroom. It is the responsibility of the head painter to request that sufficient quantities of paint be ordered when the normal amount carried in stores is less than the requirements of the job to be done. All miscellaneous supplies are ordered by the head painter as needed and charged direct to the job.

To improve paint performance a uniform method of testing paints has been worked out so that results can be compared on a standard basis. The testing of paints to ascertain their adaptability is under the direction of the plant engineer. Of course the purchasing department has the right to submit samples for testing to determine their fitnes and ability to meet standard specification requirements.

Paint Test Data

When a sample of paint is tested the following data are taken and entered on a Paint Testing Data Card:

1. Location and conditions under which test is made.

2. Manufacturer's name and address.

3. Kind of paint and serial number.

4. Weight per gallon and chemical analysis.

5. Amount of thinning the paint will stand.

6. Flow and brushing characteristics.

7. Amount of material required to cover 100 sq. ft. of surface.

8. Time required to paint 100 sq. ft. of surface using a 5-in. brush.

9. Opacity of the paint.

10. Time required to dry under normal operating conditions of temperature and humidity.

11. Appearance of newly painted surface, including presence of high and low spots, evenness, smoothness or roughness to the touch, and similar characteristics.

12. Time interval between observations and total length of the period during which tests are made.

13. An accelerated paint color durability test is made at the same time the regular test is made and the sample is compared with the panel of the regular test. This accelerated test is made by painting a metal test panel the same as the regular test panel, then wrapping it in photographer's black tissue paper and placing it under the same conditions as the exposed sample.

14. Color durability of the paint and the length of time before the paint fades or turns. At the time the paint is seen to have faded, the color is tested and compared by applying a strip of fresh paint over the sample tested. This fresh paint is part of the original sample which is saved for this purpose.

15. Amount of dust accumulation on the painted surface. This is noted at the same time that the color-holding properties are determined.

16. Washability of the paint surface, and appearance after washing.

17. Characteristics of the paint surface as to chalking, peeling, cracking, and so on.

18. Cost per painter's square (100 sq. ft.) to maintain surface:

(*a*) First cost of painting:

1. Cost of material per square
2. Cost of labor per square

(*b*) Unit cost of painting on ten-year basis.

When paint is applied to a test panel the latter should not be smaller than 18x24 in., preferably 24x30 in. If the paint is applied to a wall or building surface, the area covered should not be less than 3x5 ft. and should preferably be 5x5 ft. or a quarter square.

Standard procedures that have been adopted for testing paint samples on various surfaces are as follows:

1. *On a weather-aged piece of galvanized iron.*

(*a*) First coat, a galvanized-iron primer and sealer.

(*b*) Second coat, an undercoat of sample submitted.

(*c*) Third coat, the finishing paint of sample submitted.

2. *On wood panel or wall.*

(*a*) First coat, a proper sealer or coat of flat, white paint.

(*b*) Second coat, an undercoat of sample submitted.

(*c*) Third coat, the finishing paint of sample submitted.

3. *On plaster wall.*

(*a*) Surface is thoroughly washed before applying paint.

(*b*) First coat, a wall primer and sealer.

(*c*) Second coat, an undercoat of sample submitted.

(*d*) Third coat, the finishing paint of sample submitted.

Note: If surface was formerly painted with cold water paint, a standard solution of zinc sulphate should be used when washing wall. If surface was formerly painted with an oil paint, wash with standard solution of soap powder.

4. *On concrete or brick wall.*

(*a*) Wall is thoroughly cleaned before applying paint.

(*b*) First coat, a proper sealer.

(*c*) Second coat, an undercoat of sample submitted.

(*d*) Third coat, the finishing paint of sample submitted.

5. *Metal paint tested on a panel or under service conditions.*

(*a*) New work or metal that has not been painted.

(1) Wash surface with 10 per cent copper sulphate solution.

(2) First coat, a proper sealer.

(3) Second coat, an undercoat of sample submitted.

(4) Third coat, the finishing paint of sample submitted.

(*b*) Old work or metal that has been painted.

(1) First coat, a proper sealer.

(2) Second coat, the finish coat of the paint sample submitted.

6. *Varnishes:*

Use a wood panel (oak or pine) or the wood furniture to be finished.

(*a*) Stain wood to desired color.

(*b*) Use wood filler if necessary.

(*c*) First coat may be white shellac, but for a first-class job to withstand hard wear use varnish.

(*d*) Second coat, varnish sample submitted.

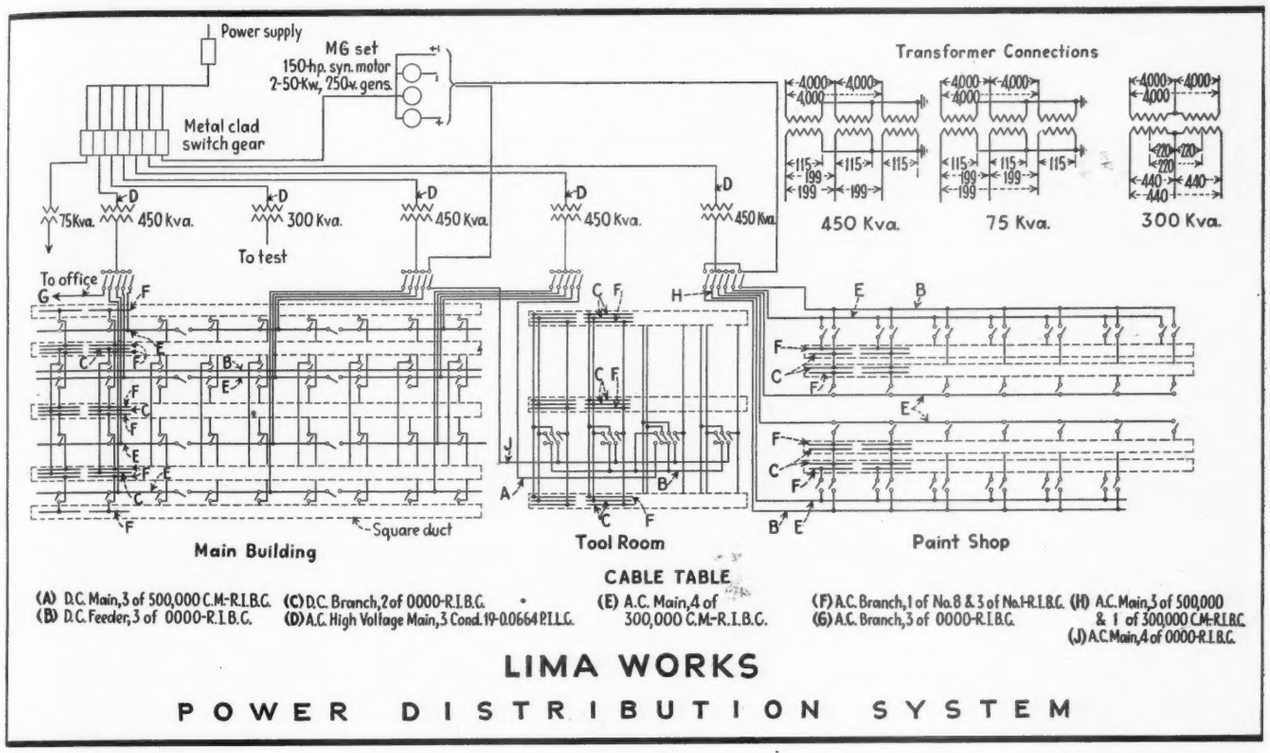
PAINTING RECORDS

Bldg. No._____ Floor No._____ Occupancy_____ Area No._____

Approximate No. of painters Surface Sqs. in area_____

DATE	OPERATION	Approx. Total Sqs. Wkd.	LABOR Man Hrs.	LABOR Cost	BURDEN	MATERIAL Amt. Gals	MATERIAL Cost		REMARKS

They give the cost and all needed information about every painting job



Revamped Distribution for Flexibility

Because that is one of the very important factors in obtaining flexibility of production, through shifting machines around in order to meet changing conditions

W. WENDELKIN

Works Electrical Engineer
Westinghouse Electric & Manufacturing Company
East Pittsburgh

NEED OF ADDITIONAL facilities for the manufacture of small motors, and the advisability of consolidating this activity in one plant, led our company about a year ago to transfer its small motor plant from East Springfield, Mass., to the old Garford Motor Company truck plant at Lima, Ohio. In the process of converting this property into a small motor manufacturing plant, many important and interesting problems required solution.

The operating success of such a plant depends to a great extent on an adequate power distribution system. Conditions at the old plant when it was taken over obviously were inadequate to meet present-day manufacturing requirements, so far as the electrical distribution system was concerned. All the motor drives and lighting circuits were energized from a 250-volt, d.c. supply. There was no alternating current available within the plant. The old distribution system also was inadequate to handle the multiplicity of motor drives that were to be installed in the new set-up; it became necessary, therefore, to rewire the entire plant for alternating current.

Study showed that the most economical distribution could be obtained with a power supply of 4,000 volts, three phase, 60 cycles. All switching equipment, transformers, and other apparatus were therefore ordered and designed for this voltage. In view of the large area occupied by the plant, it was decided to distribute the high voltage to various outlying transformer stations within the plant, where it is stepped down to a voltage suitable for motors and lights. The general layout of the system is shown in the figure.

A 100-kw. motor-generator set was installed to provide d.c. power for the plant. This set consists of two 50-kw., 250-volt, d.c. generators operating in series with a neutral point taken off between the two machines in order to distribute d.c. power at 250 and 500 volts. The generators are driven by a 4,000-volt synchronous motor, which

Main feeder buses are carried in conduit along each side of the main building. One of the square troughs that contains the branch feeders can be seen at the left, supported from the roof trusses

helps to correct the plant power factor.

All power, both alternating and direct, is distributed underground from the main switchboard by means of paper-insulated, lead-covered cables operating at 4,000 volts and leading to the various transformer stations throughout the plant.

These transformers, which are of a new type, are rated 150 kva. and are natural-draft, air-cooled. Since they require no cooling medium, such as oil, their installation is considerably simplified, because it is not necessary to provide vault inclosures, sewer drains, and other accessories commonly required when oil-filled transformers are used.

As will be noted, the transformers are mounted on an elevated concrete pad, and are inclosed with wire screening. The distribution breakers are located in an inclosed cabinet immediately in front of the transformer station.

Incoming high-voltage cable is brought up in the rear of the transformers, out of the way, where it is pot-headed, and connected to the high-voltage terminals. The secondary distribution system supplied from these transformer stations is a four-wire, three-phase design, which provides 199-115 volts for power and lighting, and thus eliminates the need of separate lighting transformers and buses. The transformers are connected star-star, as would be expected, with the neutral points of both the high-voltage and low-voltage windings grounded so as to eliminate unbalanced phase currents.

Independent Banks

Secondary distribution system throughout the building comprises the transformer stations, each rated 450 kva., which feed into a secondary network. Essentially the system consists of separate main bus sections for each transformer station, which are tied together through bus-tie switches, thus permitting each transformer bank to be operated independently of the others, and making it possible to operate the entire system in parallel. In the event of failure, a transformer station can immediately be segregated from the network, and the load carried by the other banks.

These main feeder buses are carried throughout the buildings in conduit containing 300,000-circ.mil cable for the a.c. power and 4/0 cable for the d.c. energy. Main buses run lengthwise along each side of the main building.

Branch feeders for supplying power to the machine tools on the floor are carried in a square metal trough which is supported from the roof trusses and also runs lengthwise of the aisles. This trough is provided with knockouts along its entire length, from which flexible conduit is dropped to the machine tools below.

The feeders in this trough are controlled by switches mounted on every other column, which serve to segregate the feeders into sections approximately 40 ft. long. This arrangement makes it possible to confine any circuit trouble to one or two sections and thus prevent operation of the remainder of the equipment on the floor from being interferred with.

This method of running the feeders also eliminated the always bothersome and expensive job of chopping and drilling floors that is necessary when running conduit lines to motors. In

addition, it provides a high degree of flexibility because any machine tool may be shifted to any desired location along the trough and be easily and quickly reconnected.

Number and spacing of these metal troughs are, of course, determined by the physical layout of the production equipment. Existing troughs can readily be shifted, or new ones added, to meet new conditions.

Modern Lighting, of Course

The rehabilitation of this plant naturally called for a modern lighting system. Combination Glasteel mercury and incandescent lamp fixtures were used throughout the plant. The only exception is the general offices, where semi-indirect, Alzak aluminum fixtures were installed. These combination fixtures contain a 400-watt mercury-vapor lamp with three 200-watt incandescent lamps. The fixtures are spaced on approximately 16-ft. centers. and are mounted 15 ft. from the floor.

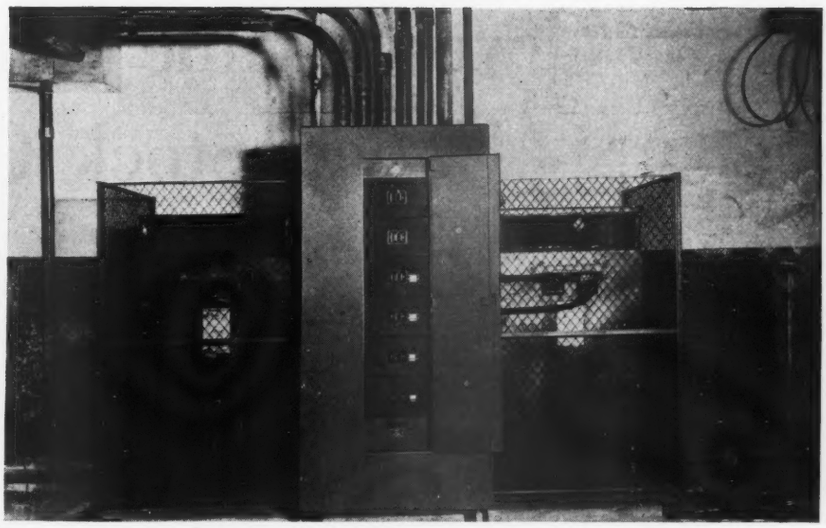
The average intensity of illumination throughout the shop area is about 35 foot-candles. In the general offices, where 500-watt units are used, it is 30 foot-candles.

All of the lighting equipment is controlled from AB Nofuze panelboards located at various convenient points on the manufacturing floors.

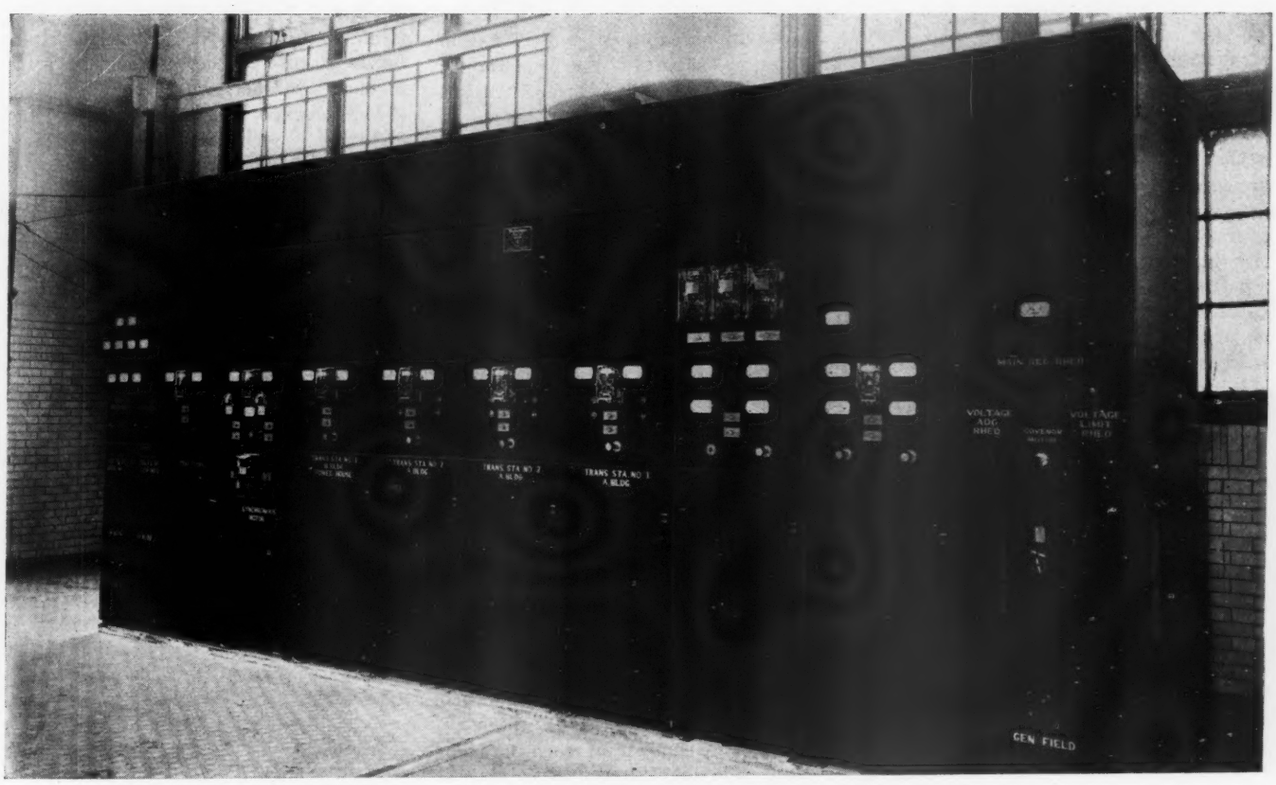
Since the communication and signaling facilities were inadequate in the old plant, it was necessary to install a new telephone system, fire alarm, and timekeeping equipment. Therefore, a 200-pair automatic telephone exchange was put in, and new branch telephone cables were run in conduit to all parts of the plant. This telephone system also includes a paging arrangement.

A new timekeeping system consisting of a master clock, secondary clocks, and time stamps designed for hourly correction of the time, was also installed with all of the branch wiring placed in conduit.

Altogether, it is felt that the entire electrical installation in this plant is as modern and reliable as present knowledge and equipment can make it. In any event, during approximately a year of operation, maintenance expense has been practically zero, and the flexibility of the system has been well demonstrated.



One of the several transformer stations serving the plant. The distribution breakers are shown in the foreground



Incoming power is controlled and distributed from this main switchboard

Twelve-Time Turnover Halves Stock Costs

No more obsolete maintenance stock at Buick. Single storeroom serves all departments. Stock now moves once a month. Inventory is half what it used to be. And, most important, so is operating cost

FRED PYPER
Master Mechanic
Buick Motor Company

MAINTENANCE stockrooms are apt to be neglected in the efforts of management to reduce costs. This neglect may be due to failure to see things obviously under foot, or it may arise from the mistaken belief that stocks, even though large, must be kept at a high level to avoid stoppage of production for want of a tool, or for any of the many items carried.

That is pays to devote some constructive thinking to this phase of plant operation is amply proved by our experience over the past six years. During this time the size of maintenance stock inventory has been reduced to half its former size, costs of operation have been just about halved, and obsolete stock has been practically eliminated. In addition to these very tangible results, service to the operating departments has greatly improved, and the thinking and experience of the line organization have been brought to bear on the proper inventory level for items, tools especially, not carried as standard stock items.

These accomplishments have been brought about by changes made in organization, in the clerical work of receiving and storeroom operation, in ordering standard perishable tools, in reporting on the monthly variations in size of the various classifications of maintenance stock, and in disbursing stock to operating departments.

Under the old plan we had a group of decentralized storerooms for this material; now there is only one storeroom that carries stock included in the plant inventory. And this single room services the several separate manufacturing buildings in which the Buick car is built.

Under the old set-up, only items used by two or more departments came to central stores. Items special to one manufacturing department were delivered from the supplier to the proper factory storeroom. This arrangement meant that there had to be a receiving clerk to receive the material, and a storekeeper to maintain it, each with the requisite clerical force to keep records. To add to the complication, this factory stockkeeper doled his stock out to the adjacent crib man, who in turn passed it out to the user on requisition.

Aside from being costly, this procedure had an important effect on the size of the inventory. Central stores carried a 30-day stock, and these factory storerooms also carried a 30-day stock.

Now all stock is kept in central stores and is sent as needed to the crib man in manufacturing departments. In addition to tools, he passes out all items of maintenance material, Incidentally, he is responsible to the chief maintenance storekeeper, who in turn reports to the master mechanic.

As would be expected, this change in organization changed the amount of paperwork necessary. Formerly, when material left central stores, it had to be sent on a special form, or shipper, which recorded its leaving and also served as a means of adding to the balance in the factory stores.

One for the Foreman

The procedure, by comparison, is now very simple. An expense requisition is made out in four copies, signed by the foreman. He retains one, and hands the remaining three to the crib man, who forwards two to central stores. The latter sends one copy to the factory accounting department and returns the second one to the crib man with the material.

The moment material leaves the central storeroom it is charged into expense and is recorded against the department requesting it. No records or balances are kept in the crib. This means, of course, that material is not withdrawn until needed, since it shows up in the daily expense budget of each foreman.

Here a further simplification may be mentioned. When stock was to be sent to factory storerooms, under the old procedure, a copy of the shipper previously mentioned, listing by hand all items included, had to be furnished the central traffic department. A signature had to be secured on this copy as evidence of responsibility discharged. Now a pick-up truck from central stores services all cribs twice daily, and the costly interdepartmental checking is eliminated.

Throughout the changes made in the organization of this service the central idea, aside from simplifying the procedure, has been that each man should be given a definitely prescribed task and held responsible for it. The consequence is that our stockroom is orderly and there is no confusion in carrying out the various tasks. Each man has definite responsibilities. No one, not even the head storekeeper, interferes as long as the duties are properly performed. This is an important psychological principle, for it permits the development of pride in successful performance.

Maintenance stock is divided into eight classes, each of which is controlled by special account in the factory accounting system. In the storeroom a storekeeper is assigned to each class, who is responsible for ordering and having on hand enough of his material. He is also responsible if he orders too much.

Performance on each of these counts is published monthly by the factory accounting department, and comparison is easily made with previous months to determine whether each storekeeper's inventory has increased or decreased. A copy of the monthly inventory report is given to each of the eight storekeepers, which permits them to compare their standing with others.

Reduction in the amount of clerical detail involved in receiving materials is another great change in procedure. We used to copy from the packing slip to a check sheet, and then transfer this to a receiving slip. The receiving slip was matched with the bill of lading to verify the check sheet. Then the receiving slip was matched with the invoice. These steps were time-consuming and costly.

Now the receiving checker matches the packing slip with his copy of the purchase order to see that the material was ordered; then he checks the material received. If everything is correct, the checker signs the packing slip and turns it over to the receiving clerk. This original check is the best possible evidence that the invoice should be paid; no amount of subsequent cross-checking will make this primary check any more accurate than it is.

The signed packing slip is compared with a registered copy of the invoice and the register number noted on the packing slip, which is permanently filed. The invoice is now checked with another copy of the purchase order, to verify the fact that the material was ordered, and the invoice register number entered.

This change eliminated the laborious filling-out of separate forms in receiving, which in no way added to the accuracy of the results.

One of the eight classes of maintenance material is hardware, which covers a multitude of items. Because of the wide range of items, we used to have difficulty in ordering, stocking, and issuing material. A multiplicity of clerical detail was involved in maintaining a balance on each item. For the past four months no stock balance has been kept on these items, and the plan works.

Automatic Notice

For each bin there is an identification card describing the material in the same terms that will be used on the purchase order in buying. A duplicate of this card, about the size of a calling card, is stuck back of it in the metal retainer on the face of the bin. When the minimum is reached, this duplicate is taken to the stockkeeper's desk. It is an automatic notice to him to send the appropriate stock card to the office to have a purchase order written. The duplicate bin tag is then returned to its place. Since the ordering quantity is noted on these cards, no further instructions are needed by the stenographer.

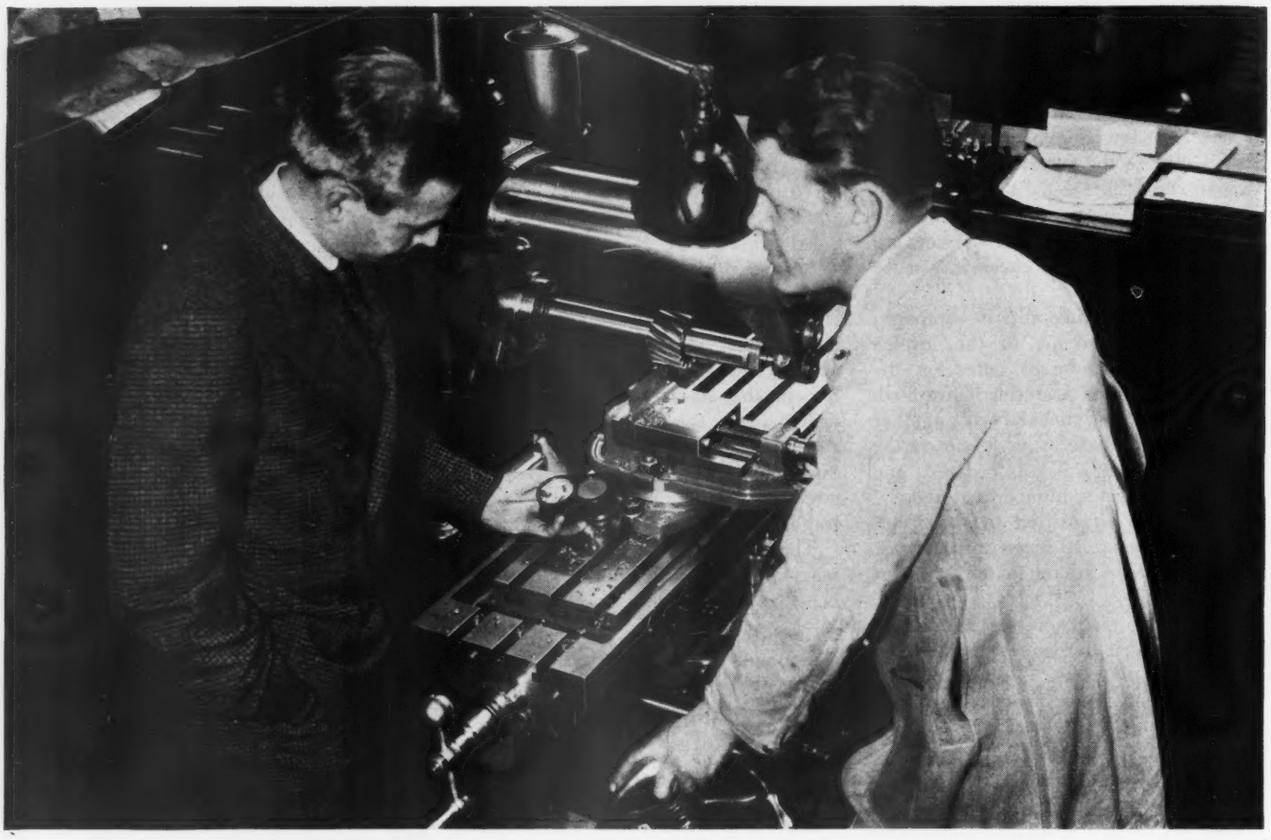
No pencil work is required in this whole procedure, costs are reduced, and considerable time is saved in addition.

Instead of buying and stocking each individual cutting tool ground to the correct angles by the supplier, we buy tool blanks. These blanks are marked and etched with the correct tool number in the stockroom and sent to the crib man in the factory. The grinding room, attached to each crib, then cuts and grinds these blanks into the desired tool. One blank may be cut into a hundred or more different tools.

The net result is that a $3 or $4 tool may, with the expenditure of some 20 cents in grinding costs, be made from a blank costing much less, and we do not need several hundred bins in the stockroom to care for these individual tools. If a tool is discontinued because of an engineering change, the stock of blanks from which it was made may still be used for many other tools, and no expensive stock need be consigned to the scrap heap.

New situations will, of course, call for new solutions. The plan as outlined works remarkably well. Under it clerical costs have been just about halved and our inventory value reduced to a fraction of what it was. We anticipate additional changes, however, as suggested by abandoning the stock balance for hardware items. We are constantly analyzing purchase costs as related to quantities bought and methods of stocking. The maintenance stock now turns twelve times a year, and the amount of obsolete material sent to the junkpile is practically negligible.

Maintenance stock is divided into eight classes. A storekeeper is assigned to each class. He is responsible for having enough of his material on hand



When new equipment is installed in this plant the illumination is checked to determine whether it meets the recommendations—in this case, 20 foot-candles

Ask Your Lightmeter

If a problem is concerned in any way with lighting, there is a good chance that a foot-candle meter can help you find the right solution. But don't limit its use to an occasional check-up

G. A. VAN BRUNT
Associate Editor

WHENEVER a change in plant lighting is considered these days, the decisions are likely to be based on foot-candle measurements made with one of the small photoelectric lightmeters commonly employed by lighting specialists. Use of a lightmeter for such purposes is highly recommended because it takes the guesswork out of important problems. However, if its use is limited to an occasional check-up, or the rare times when the lighting system is being revamped, several possibilities are being overlooked.

In many industrial plants such meters have been found very effective in reducing certain kinds of maintenance costs, in addition to their more obvious uses in maintaining proper seeing conditions for productive efficiency and employee welfare.

One valuable application of the foot-candle meter is in planning the location or relocation of plant equipment with respects to windows and skylights.

For example, when a rearrangement of equipment is contemplated in one large machine tool plant, meter readings are taken at various possible locations in order to determine the extent to which the existing lighting facilities will have to be supplemented with additional light sources. A certain section or area may thus be found to be particularly desirable for operations that require exceptionally good seeing conditions, such as inspection or fine hand or machine work. Less exacting operations may then be located in places where the lighting is of a lower order of intensity, but adequate for the tasks involved.

Frequently a shift in the location of one piece of equipment may alter lighting conditions for other equipment near by. If the machine that is relocated is higher or lower than the equipment adjacent to it, it may cast shadows which will change existing illumination levels to such an extent that relocation or addition of lighting units will be required. The effect of such changes can

be determined, on a factual basis, of course, only by foot-candle measurements throughout the areas involved, under varying levels of daylight at different times of the day.

Upon casual inspection the eye is at best a poor judge of light quantity, although it will complain bitterly if it is forced to do exacting work under inadequate light. It is therefore advisable to check the readings obtained with the foot-candle meter against the levels of illumination recommended for the kind of work involved. These recommendations, which have been published in preceding issues of *Factory*, and are available in various manuals and handbooks, are based on wide experience and study, and have been carefully worked out. They are a valuable, general guide.

What Dust and Dirt Can Do

Tests by several organizations have shown that dust and dirt on windows, skylights, or lighting fixtures may cut down the intensity of illumination as much as 50 per cent. In industries where considerable amounts of foreign matter from the manufacturing processes are likely to be suspended in the air, the efficiency of the lighting system and the desired intensity of illumination can be maintained only by frequent cleaning.

In many plants the frequency with which windows and artificial light sources are cleaned, is now determined by an occasional inspection, or else it has been placed on some sort of time schedule. Accumulation of dust and grime, however, does not necessarily proceed at a constant rate. It is quite possible that under certain circumstances lamps and reflectors will gather more dust and dirt in a comparatively few days than they will in a month at other times. Certainly the volume of production, and possibly atmospheric conditions, are among the factors that influence the frequency of cleaning.

For this reason there is much to be said for a cleaning routine based on foot-candle readings taken at regular intervals in the plant. A minimum limit for readings can readily be established, at which time the lamps and windows should be cleaned. Under this procedure it will be possible to keep the efficiency of the lighting system high at the minimum cost for cleaning.

An interesting example taken from the experience of a large industrial plant shows how foot-candle readings can be used in determining the need for painting. Not long ago the superintendent of the assembly department took meter readings of the illuminations levels at different places throughout the department. On the average the readings showed 8 foot-candles in the front and center of the room, and 11 foot-candles in the rear. In order to increase the lighting to the level recommended for the character of the work, the assembly room was given a coat of white paint.

Readings were again taken after painting, when the outside light intensity was the same as before. This time uniform readings of 28.5 foot-candles were obtained in the front, center and rear of the room. Percentage increase in intensity was 256 per cent in the front and center, 159 per cent in the rear.

In addition to determining the desirable frequency of painting, comparative tests can also be made with a meter to show the results obtained by using paints of different types or colors. When there is doubt as to which color to use, a decision should usually be made on the color that has the highest reflective power, assuming that it is satisfactory in other respects.

Daylight conditions vary so much from morning to evening that the question frequently rises whether and when the daylight is adequate for good seeing in the plant. Meter readings taken at different seasons of the year will indicate, under normal circumstances, approximately when it is necessary to supplement daylight with artificial light. In this way it is possible to make sure that adequate light is provided at all times, and under all conditions, and at the same time prevent unnecessary burning of lamps.

A foot-candle meter will also be found to be very useful in selecting or testing lighting fixtures or units. Under some conditions certain types of units may decrease in efficiency more quickly than others. Readings taken after the installation has been in operation for some time will provide data for a second comparison which, from the standpoint of operating efficiency, may be just as important as the first one.

At all times it is important to remember that when an ordinary light meter is used to determine illumination levels provided by mercury-vapor lamps it will normally give readings that are somewhat lower than the true values, because of the particular color spectrum of mercury light. Multiplying the actual meter reading by the factor 1.2 is a simple method of correction.

False Economy

Where illumination levels under mercury, sodium, or neon lights are required with considerable accuracy, a meter equipped with a special full-correction filter should be used.

In cases where frequent and wide fluctuations in voltage cause abnormally rapid burning-out of bulbs, the attempt is sometimes made to mitigate the trouble by using bulbs of higher voltage rating. This expedient does not always provide the best solution, because a serious decrease in efficiency occurs when lamps are operated below their rated voltage. Hence the use of higher-voltage bulbs may be false economy; the smaller percentage of burned-out bulbs may be more than compensated for by the lower efficiency of the lamps. In any event a foot-candle meter will provide factual data that will go a long way towards eliminating guesswork and costly mistakes.

The operator complained that daylight illumination was not enough—and the foot-candle meter proved to the satisfaction of all concerned that he was right

They'll Never Lose a Hand or an Eye

Guards alone won't make a plant safe. But they're potent medicine. Six samples out of a plant that has rolled up enviable lost-time-accident records

J. F. ANDREWS
Assistant Editor

OPERATION for nearly 2,000,000 man-hours without a lost-time accident has made the Endicott, N. Y., plant of International Business Machines Corporation winner of the 1937 industrial accident prevention campaign conducted by the Associated Industries of New York State. Good as this record is, it is not the best that has been made at this plant.

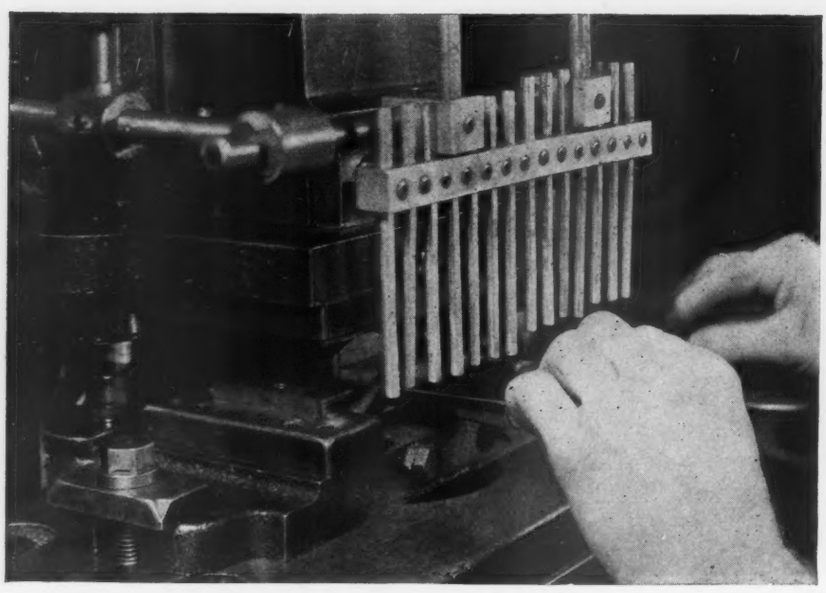
From August, 1936, to June, 1937, it operated a total of 4,570,064 man-hours without a lost-time accident. Resuming in July, 1937, it has gone nearly 4,000,000 man-hours without such accidents, and is making an effort to break the former record. The plant employs more than 4,000 people and operates in excess of 6,000,000 man-hours a year.

In the 10 years from 1928 to 1937 the Endicott plant, while doubling its man-hours of operation and more than trebling the number of employees, reduced man-days lost through accident from 749 in 1928 to 5 days in 1937.

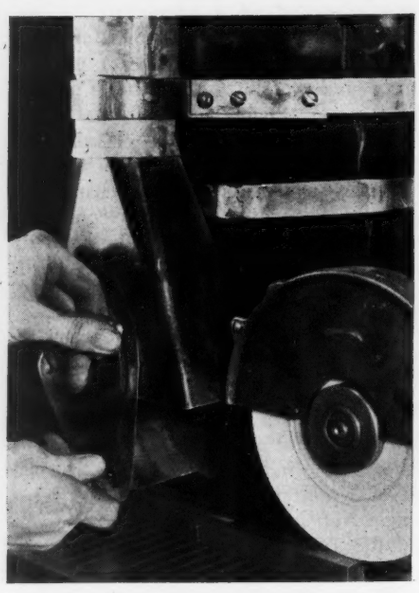
In the same period the frequency index was reduced from 13.9 lost-time cases per million man-hours in 1928 to 0.29 cases in 1937, and the severity index from 0.248 days lost per thousand man-hours worked in 1928 to 0.0007 days in 1938.

All of this has been the result of skillfully organized safety work and ingenious methods of safeguarding machines, some of which are shown here.

Transparent guard on wire cutter enables machine operator to see what she's doing. Stops her from sticking her hand inside while the cutter is running

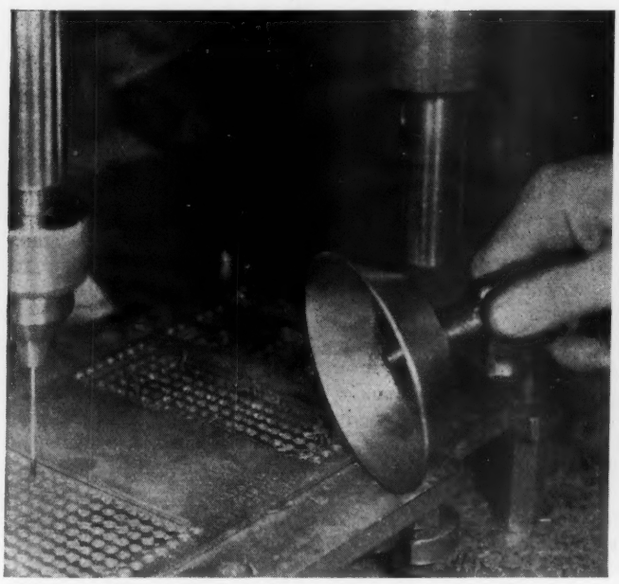


Sometimes, on repetitive jobs, a young man's fancy lightly turns to thoughts of anything but the press he's running. But this man's fingers can't wander



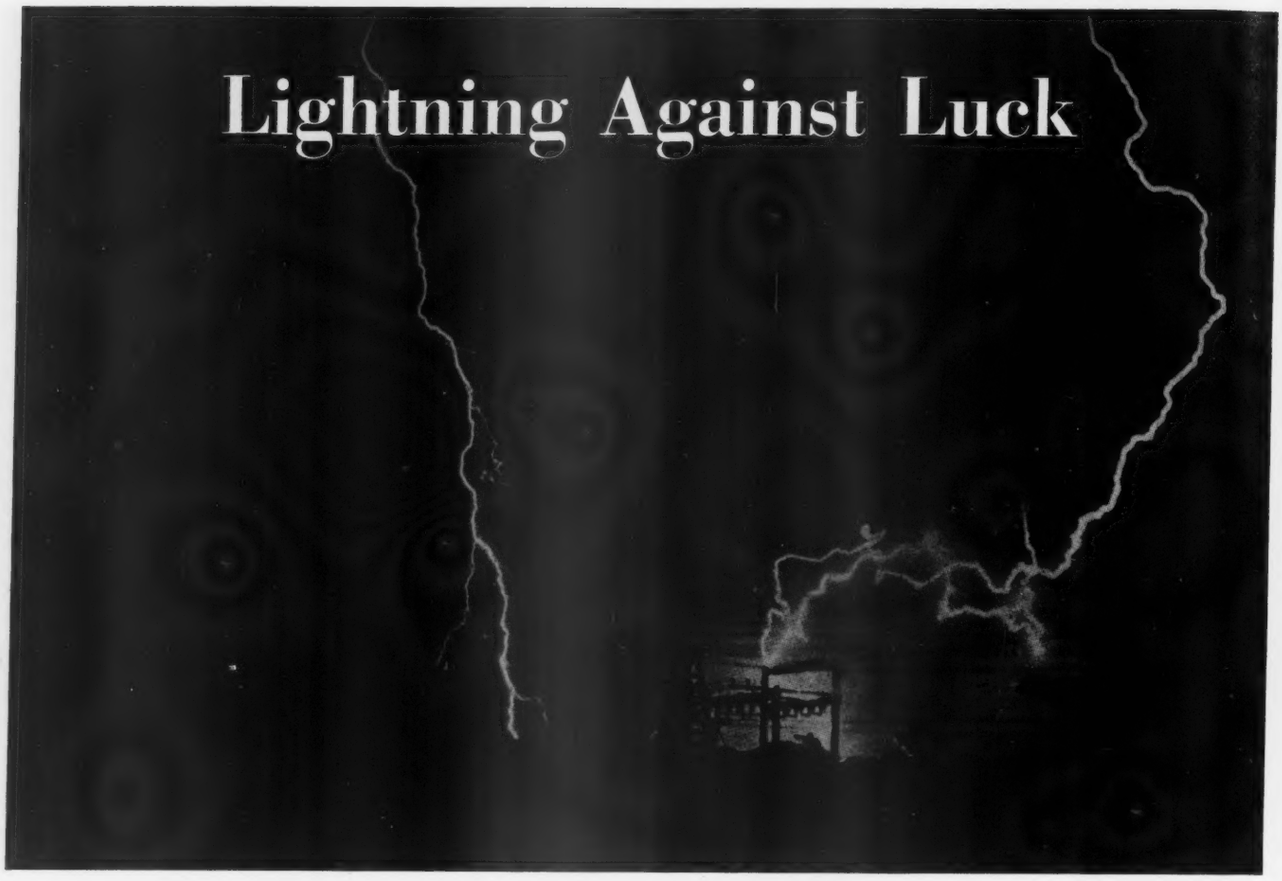
Hands and eyes are safe wth grinder hood on duty. Exhaust is adjustable

The hand—in punch press operations, at least—is not always quicker than the die. Hence the handcuffs. As the die descends, the operator's hands are pulled out of the danger zone. He knows he's safe. He can't get caught



It's safe to blow out chips with the air hose. Nozzle guard prevents them from flying in the operator's face

Takes two hands to run this guillotine cutter. That's the sure way of keeping them away from the deadly blade



Lightning Against Luck

Is a gamble against overwhelming odds, because the fiery bolts always win. But odds can be completely reversed by the right equipment, properly installed

H. M. TOWNE

Central Station Department
General Electric Company
Pittsfield, Mass.

IN THE DISCUSSION on methods of protecting rotating machines and other kinds of electrical equipment against lightning, which appeared in the April issue, it was pointed out that present practice is to locate arresters close to or on power transformers.

When arresters are so mounted, the lightning stresses entering the transformer are definitely limited to the voltage allowed by the arresters. The arrester ground is automatically interconnected to the transformer tank, thus eliminating added stress on the transformer from the ground resistance *IR* component adding to the arrester voltage. Reflections cannot impose any higher voltage on the transformer than is allowed by the arrester.

If the arrester is located a considerable distance away from the transformer, the latter is subjected to reflections that may be appreciably in excess of the voltage allowed by the arrester. For any given case, the increased voltage stress by reflections depends on the steepness of the lightning wave and the circuit-feet distance from the arrester.

The relations between these factors are shown in Figure 1. Although the assumed wave front of 1,000 kv. per microsecond is probably more severe than commonly encountered, the curves are relative and indicate the possible sacrifice in protection under severe conditions when arresters of different ratings are located various distances away from the point *P* to be protected.

For example, a 138-kv., ungrounded-neutral arrester (twelve Thyrite arrester units, line-to-ground) will limit the lightning voltage to 480 kv. crest at the arrester, but 680 kv. may exist 100 ft. away from it. Again, a 69-kv. arrester (six Thyrite arrester units, line-to-ground) will permit but 240 kv. crest at the arrester; but 320 kv. may occur 40 ft. away, and 440 kv. 100 ft. away from the arrester. It should be recognized, however, that these excess voltages at point *P* exist only for an extremely short time, or until reflections between *P* and the arrester equalize the voltage to that at the arrester.

Remembering that the impulse volt-time flashover value of pin-type or bus insulators, bushings, or gaps increases very rapidly for short-time voltage applications, it is clear that this class of insulation can better withstand the short-time voltages in excess of that allowed by the arrester. Transformer insulation, however, has a more nearly flat volt-time impulse breakdown characteristic. Therefore, if only one arrester is to be used in a station, it is preferable to locate it reasonably close to the transformer, even though some switches, breakers, or bus insulators are some distance away from the arrester.

In the larger stations, arresters may be installed on each outgoing line as well as at the transformer. In any

case, the capacitance of the combined station apparatus helps to mitigate the short-duration reflections between apparatus and the arrester.

Avoid Fuses of Low Rating

If the location of the arrester is such that the impulses from the exposed lines must pass through fuses before reaching the arrester, the fuses may be blown by the lightning current, unless they are of sufficiently high ampere rating. Based on experience, 3- or 5-amp. fuses may very frequently be blown by lightning discharge currents passing through them. Hence in any protective arrangement it is desirable to avoid fuses of low rating between the line and the arrester.

Cables connected to exposed overhead lines will usually require protection. When a wave from the exposed line enters a cable, the lower surge impedance of the cable reduces the initial transmitted wave to about 20 per cent. However, when the length of the lightning wave is several times the length of the cable, a succession of voltage reflections will build up the voltage in the cable to practically the full value of the applied wave.

Lightning arresters should be installed at the junction of the exposed overhead line and cable to protect the pothead and limit the voltage stress on the cable insulation. Figure 2*A* shows two, three-phase sets of 12-kv., station-type arresters for a 13.8-kv., grounded-neutral system, installed on the junction pole between 13.8-kv. cables and exposed overhead lines. In Figure 2*B* is shown a three-phase set of 15-kv. distribution-type arresters installed at the junction of 13.2-kv. cables and overhead lines.

In both cases the ground terminals of the arresters are connected directly to the cable sheath so that they are in direct shunt relation to the cable insulation. The arrester ground terminals are also connected to a low-resistance, driven ground at the base of the pole.

The station end of such cables should have the cable sheath or armor directly connected to the main station ground to which all apparatus frames and station arresters are grounded.

Neutral Systems

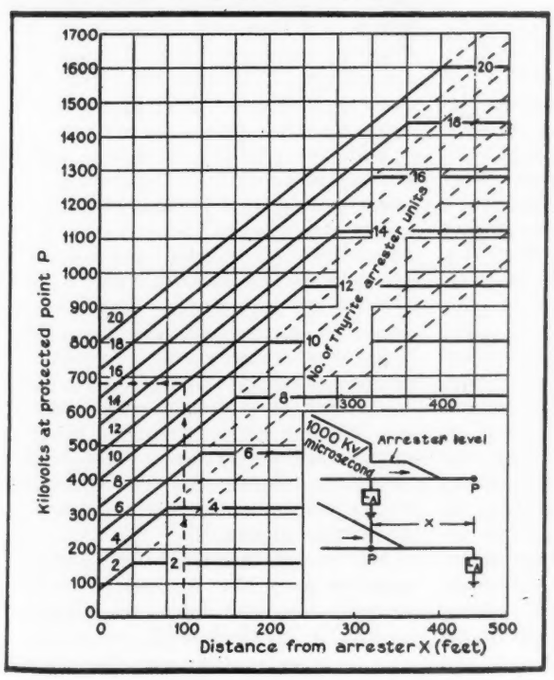
No difference in the severity of lightning is to be expected for ungrounded-neutral or grounded-neutral systems of comparable rating. Magnitude of lightning potentials for either class of circuit depends only on the exposure. However, line or station insulation flashovers are more likely to cause system short-circuit interruptions on grounded-neutral systems.

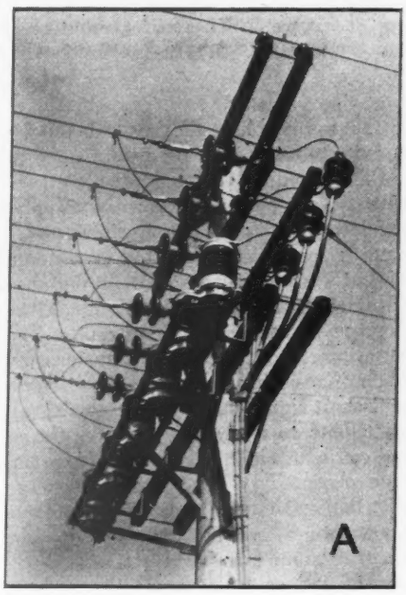
Arresters for ungrounded-neutral systems should have a maximum permissible line-to-ground valve or reseal root-mean-square voltage rating of not less than the maximum phase-to-phase operating voltage of the system. The reason is that the ungrounded neutral system may operate for limited periods with a ground fault on one phase, resulting in the two unfaulted phases being full phase voltage above ground. Standardized arrester ratings for ungrounded-neutral systems possess a suitable margin of safety in maximum rating above the respective nominal system voltage ratings. For instance, arresters having 15-kv. r.m.s. maximum line-to-ground rating are used on 13.2- or 13.8-kv., ungrounded-neutral systems.

The solidly grounded neutral system permits the application of lower-rated arresters, giving better protection at lower cost. In general, standardized arrester ratings for solidly-grounded-neutral systems involve an arrester maximum rating which is about 80 per cent of that used on ungrounded-neutral systems. For example, arresters having 12 kv. r.m.s. maximum line-to-ground ratings are used on 13.2- or 13.8-kv., solidly-grounded-neutral systems.

The interpretation of "solidly grounded" is that the neutral of all generating or power sources to the circuit shall be permanently and directly connected to a very low resistance ground

Figure 1. Protection afforded by arresters at different distances. These curves are based on a traveling wave of 1,000 kv. per microsecond, an arrester voltage of 40 kv. per unit, and zero capacitance at *P*. Solid curves apply to an arrester on the line side of a protected point, whereas dotted lines apply to arresters on the far side of the protected point





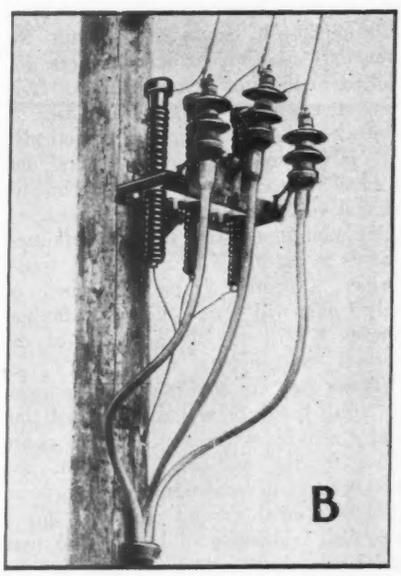


Figure 2. An installation of two, three-phase sets of station-type arresters at the junction of cable and overhead lines of a 13.8-kv., grounded-neutral system is shown at *A*. *B* shows an installation of 15-kv. distribution-type arresters

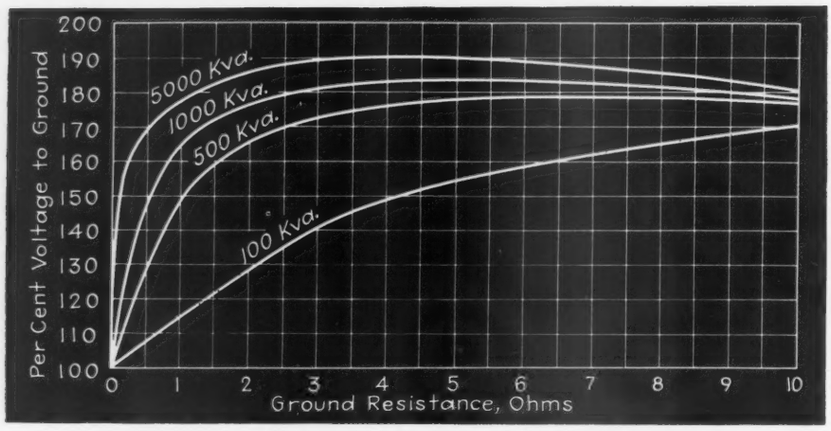


Figure 3. Effect of ground resistance on the overvoltages imposed on a three-phase Y grounded system of 2,300 volts line to ground

so as to establish the neutral of the circuit definitely at earth potential.

Prevention of neutral displacement with typical power transformers supplying low-voltage distribution circuits may often require more effective grounding of the system neutral than in the case of higher-voltage power transformers supplying a transmission system. The lower-reactance supply transformers, higher resulting short-circuit current, and short lines with lower reactance, all contribute to a greater displacement of system neutral in per cent of normal line-to-ground voltage on low-voltage distribution systems than on high-voltage transmission systems having the same neutral ground resistance.

Calculations of neutral displacement attending a zero resistance fault close to the power source on one phase of a 2,300/4,000-volt, grounded-Y circuit, for commonly used sizes of transformers, are plotted in the curves in Figure 3. It is seen that for the larger capacities, a neutral ground resistance of practically zero is required to prevent neutral displacement and assure normal line-to-neutral voltage (100 per cent on curve) being maintained from the two unfaulted phases to earth. With a 1,000-kv. transformer, a neutral ground resistance of only 1 ohm will permit the two unfaulted phases to rise to 165 per cent of the normal line-to-neutral voltage.

These data are admittedly conservative in being based on a lightly loaded line and a zero-resistance fault on one phase close to the station. However, the curves serve to emphasize the importance of low neutral ground resistance for a practical realization of little or no neutral displacement, which the term "solidly grounded" neutral implies.

Selection and application of arresters for either grounded- or ungrounded-neutral systems should involve consideration of the maximum system voltage. The lightning arrester is fundamentally a voltage device and, when properly designed, operates independently of the transmitted current, power, and size or number of generators used. Under expected conditions of operation the arrester should not have a potential applied to it in excess of its root-mean-square maximum permissible line-to-ground rating.

Occasionally, as when protecting important but very old apparatus having unusually low impulse strength, an operator may be justified in accepting the possibility and risk of an arrester failure attending infrequent or remote system overvoltage conditions, rather than apply a higher rating of arrester to withstand the infrequent overvoltage, but which might not protect the apparatus in question.

Direct Stroke Protection

No lightning protective devices alone can be depended upon to withstand, or provide protection against, all direct strokes of lightning terminating on the station, or line circuits close to the station. The wave front, current magnitude, time duration, energy, cumulative effects of multiple strokes, and other factors are still little known, but many direct strokes have manifested destructive effects beyond the expected capabilities of lightning protective devices.

Sound engineering practice therefore dictates the elimination of direct strokes on important station apparatus and protective equipment by overhead ground wires shielding the station structure itself, and the first 2,000 ft. or half-mile of exposed lines adjacent to the station.

This shielding can be effectively installed so that direct strokes will be intercepted by it instead of terminating on apparatus or circuits in the immediate vicinity of the station. At the station the shielding may take the form of extensions of the steel structure above the conductors, which may support the station end of the overhead ground wire carried out over the half-mile of lines adjacent to the station. Height of the ground wire shielding is usually determined from a protective cone whose base radius is twice its height, in addition to adequate midspan clearance.

The overhead ground wire is connected to the station ground to which all apparatus frames and arresters are grounded, and is also effectively grounded at each pole structure of the first half-mile of lines adjacent to the station. This simple and quite inexpensive shielding assures that no direct strokes can terminate on the circuits closer than 2,000 ft. from the station. Under this condition complete protection and coordination can be realized with protective equipment applied as outlined previously.

With the smaller and less important stations direct-stroke shielding may not be economically justified, particularly when they are so situated, topographically, as to be not susceptible to direct strokes at or close to the station.

Grounding Protective Equipment

Lightning arresters should be provided with short and direct connections to low-resistance grounds. It is desirable to interconnect all lightning arrester grounds to a low-resistance station ground to which machine and apparatus frames, structural steelwork, overhead ground wires, cable sheaths, system neutrals, and so on, are earthed. This common ground should preferably be connected to an accessible water piping system, since the continuous, buried water pipe usually constitutes a most effective ground. Where such an extensive and reliable low-resistance ground is provided for stations, it is desirable to use this common ground for both the high and low-voltage arresters at the station.

With the smaller substations, where absence of an extensive grounding system or water pipes prevents obtaining a low-resistance ground, some caution must be exercised in connecting low-voltage arresters to the same ground as the high-voltage arresters. Under high ground resistance, interconnection of the high-voltage primary arrester ground to the low-voltage secondary arrester ground may result in a certain component of the lightning current from the primary circuit discharging back through the secondary arresters to the secondary circuit and its connected motors or other low-voltage apparatus.

Where it is necessary for such reasons to keep the secondary arrester ground separate from the primary ground, it is still desirable from a pro-

(Continued on page 130)

A.C. Wave Windings

Connecting diagrams and tables for windings having eight slots per pole per phase

A. C. ROE

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Westinghouse Electric & Manufacturing Company
East Pittsburgh

CONNECTING DIAGRAM Figure 13, Connecting Chart XIII, and Checking Chart XIII, for a.c. wave windings having eight slots per pole per phase are given in this article. Some of the points to keep in mind when banding strap-wound windings of this type will also be considered.

In this series of articles there have been presented thirteen connecting diagrams with thirteen connecting and thirteen checking charts. Each group consisting of diagram, connecting chart and checking chart covered eleven windings, or those having from 4 to 24 poles, inclusive. Hence, the complete series has covered 143 diagrams. If the conventional type of connecting diagram had been employed it would have been possible to present only a small number of these diagrams on account of their large size. However, the comparatively small diagrams that have been shown bring out the essential details clearly and should be as useful as the other type.

A finished winding is shown in Figure 1, with the clips insulated with treated drilling caps that are made in the form of bags, dipped in varnish, and applied while wet over the clips. Two or more bags are used over each clip, the number depending on the slipring voltage and the space between clips. The drilling caps are held in place with a few turns of thin cotton tape. This tape covers the raw or open ends of the bags and holds them tight, in addition to sealing the ends.

Clips are insulated before applying the steel wire bands. Note how the band insulation in Figure 1 has been brought over close to the clip insulation. In this way the front band and its insulation are kept out towards the leads, in order to hold them solid and cover rough edges.

Insulation under the wire bands should extend at least ⅜ to ½ in. past the last turn of wire, on each side of the band, to insure proper creepage distances.

The rear coil end band is also kept over towards the rear coil loops, as Figure 1 shows.

Tinned-steel clips should be placed under the bands. These clips should be ⅜ to ½ in. wide, 0.012 or 0.022 in. thick, and long enough to permit at least a ½-in. turnover on top of the band at each end. Clips should be spaced about six slots apart, and three clips used close together where the band starts and stops.

The diameter of the banding wire

Checking Chart XIII

Eight Slots per Pole per Phase

No. of Slots	No. of Poles	Polarity	Phases C								B								A							
96	4	↑	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Z	Y	X	V	U	T	S
		↑	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18
		↑	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42
		↑	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66
144	6	↑	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90
		↑	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114
192	8	↑	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138
		↑	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162
240	10	↑	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186
		↑	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210
288	12	↑	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234
		↑	281	280	279	278	277	276	275	274	273	272	271	270	269	268	267	266	265	264	263	262	261	260	259	258
336	14	↑	305	304	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288	287	286	285	284	283	282
		↑	329	328	327	326	325	324	323	322	321	320	319	318	317	316	315	314	313	312	311	310	309	308	307	306
384	16	↑	353	352	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333	332	331	330
		↑	377	376	375	374	373	372	371	370	369	368	367	366	365	364	363	362	361	360	359	358	357	356	355	354
432	18	↑	401	400	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384	383	382	381	380	379	378
		↑	425	424	423	422	421	420	419	418	417	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402
480	20	↑	449	448	447	446	445	444	443	442	441	440	439	438	437	436	435	434	433	432	431	430	429	428	427	426
		↑	473	472	471	470	469	468	467	466	465	464	463	462	461	460	459	458	457	456	455	454	453	452	451	450
528	22	↑	497	496	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480	479	478	477	476	475	474
		↑	521	520	519	518	517	516	515	514	513	512	511	510	509	508	507	506	505	504	503	502	501	500	499	498
576	24	↑	545	544	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528	527	526	525	524	523	522
		↑	569	568	567	566	565	564	563	562	561	560	559	558	557	556	555	554	553	552	551	550	549	548	547	546

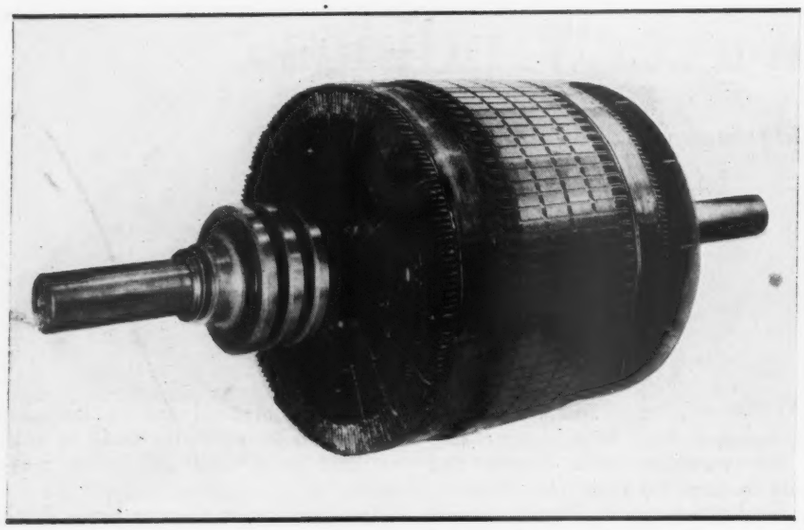

Figure 1. This winding has been wedged and banded, and the clips are insulated with cloth caps dipped in varnish before application

(3) number of layers of wire; (4) whether bands are in one piece or are insulated into two or more sections; (5) number and spacing of clips; (6) material from which band wire and clips are made—that is, steel, bronze, or nonmagnetic; (7) width of insulation under bands; (8) thickness or number of layers of band insulation; (9) material or combination of materials forming band insulation; (10) location of bands with reference to core, clips, or rear coil loops.

This seems like a long list, but the details mentioned are important and must be given consideration in order to insure a good, tight winding. In fact, as the winding is stripped, the insulating and filling material and its location between layers, on coil supports, and so on, should be carefully checked. A good winding job must be mechanically as well as electrically correct.

and number of turns per band, or width of band, are dependent on the weight of the coil ends and the peripheral speed of the rotor. Data on how to figure the size of wire, number of turns or width of band, number of clips, spacing, and so on are given in a book entitled "Rewinding Data for D.C. Armatures." This book also gives data on proper band insulation.

Inasmuch as all bands are soldered for their full width and circumference, insulation should be used that will not char or ooze varnish into the band from the heat of soldering. The materials commonly used are treated duck or treated asbestos cloth.

When stripping a rotor for repair or rewinding, removal of the bands is the first step. It is important that the following details be recorded: (1) size of wire; (2) width or number of turns;

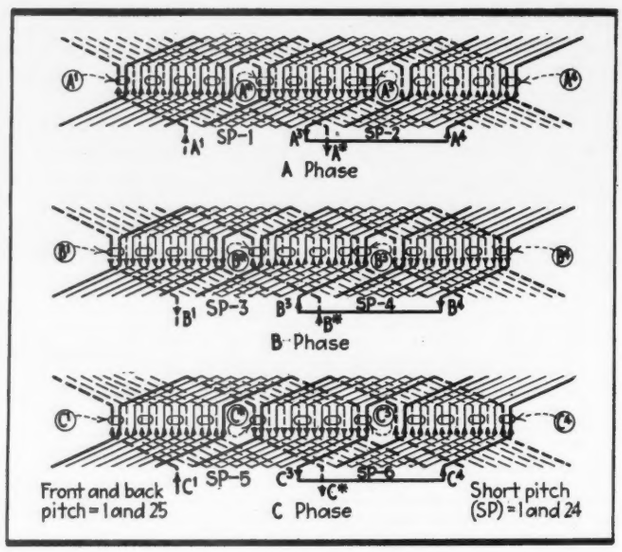

Figure 13. Connecting diagrams for a.c. wave windings having eight slots per pole per phase

Connecting Table XIII

Eight Slots per Pole per Phase

No. of Poles	No. of Slots	A Phase: Bottom Leads A¹	A*	Top Leads A³	A⁴	B Phase: Bottom Leads B¹	B*	Top Leads B³	B⁴	C Phase: Bottom Leads C¹	C*	Top Leads C³	C⁴	Short-Pitch Connections SP 1–3–5	SP 2–4–6
4	96	↑ 1	73	66	42	↓ 33	9	2	74	↑ 65	41	34	10	7	7
6	144	↑ 1	121	114	90	↓ 129	105	98	74	↑ 65	41	34	10	7	7
8	192	↑ 1	169	162	138	↓ 129	105	98	74	↑ 65	41	34	10	7	7
10	240	↑ 1	217	210	186	↓ 81	57	50	26	↑ 161	137	130	106	7	7
12	288	↑ 1	265	258	234	↓ 129	105	98	74	↑ 209	185	178	154	7	7
14	336	↑ 1	313	306	282	↓ 225	201	194	170	↑ 113	89	82	58	7	7
16	384	↑ 1	361	354	330	↓ 129	105	98	74	↑ 257	233	226	202	7	7
18	432	↑ 1	409	402	378	↓ 177	153	146	122	↑ 257	233	226	202	7	7
20	480	↑ 1	457	450	426	↓ 321	297	290	266	↑ 161	137	130	106	7	7
22	528	↑ 1	505	498	474	↓ 177	153	146	122	↑ 353	329	322	298	7	7
24	576	↑ 1	553	546	522	↓ 225	201	194	170	↑ 401	377	370	346	7	7

Front and back pitches = 1 and 25. Short pitch SP = 1 and 24. See Figure 13 for connecting layout.

Truck illustrated made by The Yale & Towne Manufacturing Co.

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Exide-Ironclads have the high power ability to handle tremendously hard work. They stay on the job from the start to the end of the day, maintaining the voltage needed for good vehicle speeds at all times. They are tough, rugged, trouble-free, long-lasting. And their economy is a matter of record.

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THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• MEDICAL SERVICE in 1,657 plants was surveyed to provide a basis for minimum standards in industrial medical practice. Digest of the findings outlines organization and function of a service, and highlights features of compensation laws. (5801)

• COMPULSORY ARBITRATION of labor disputes is one of the more drastic ways of settling differences, but a possible method nevertheless. A composite picture of legislation, agencies, and written material on this technique appears in a booklet. (5802)

• ADHESIVE, of the phenolic resin variety, bonds asbestos and rubber to metal; also, molded plastic parts, porcelain-enameled parts. Of high bonding strength, it is said to be unaffected by water, alkalis, and mild acids. (5803)

• "INSTRUMENTS IN INDUSTRY" is a new house organ published by an electrical manufacturer, that will describe new products and ways in which instruments can be used with greater benefits. (5804)

• AFRAID of wearing out your social security card? Bronze cards, about the size of calling cards, can be engraved with name and number. Company announcing this service supplies card complete with leather pocket case. (5805)

NO GLARE in light emanating from this lighting unit, for light of an ordinary bulb is passed through a transparent material that polarizes the rays. Light waves causing glare are removed, those useful for seeing come through. (5823)

• ODORLESS PAINT is supposed to have all odors removed from it by a newly discovered process. (5806)

• IF WE DON'T KNOW how we spend our money, a booklet tells us. Seventy-five cents of the typical American family's dollar goes for food, shelter, and clothing, it shows, and 17 cents for other necessities. (5807)

• BLUEPRINT PAPERS of unusually deep blue color are easier to read because there is sharper contrast between white lines and color of paper. They are said to have wide printing range, too. (5808)

• TAX POLICIES adopted at this session of Congress will have a wide bearing on American progress, the Senate Finance Committee was told. Statement of the case for wiser taxes appears in pamphlet form. (5809)

• FLOOR COVERING with abrasive particles in its surface makes floors slideproof, even when water, grease, and oil films are present. (5810)

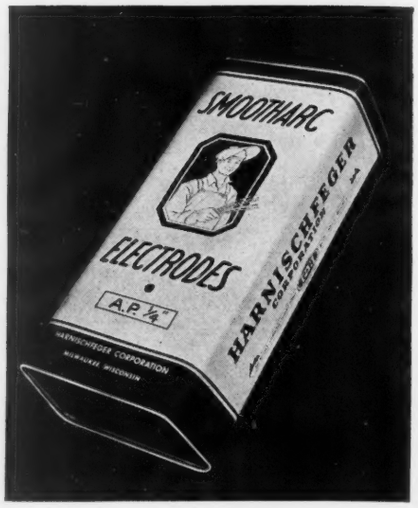
• THERMOMETER, dial type, with bimetallic actuating element, is incased in stainless steel. Stainless steel case the dial sets in is mounted on the end of a stainless steel stem. (5811)

• RESIN, soluble in water, blends with waxes, oils, shellac, latex, casein, glue to form compounds of different properties. It's a slow-drying liquid with high adhesive properties. (5812)

• MAP, showing how raw materials from every state go to make up its product, was prepared by one company, sent with the annual report. (5813)

• STEEL, high tensile, is claimed to make possible reductions in cost of manufacture of products made from it, without radical redesign of the products. Stronger than ordinary sheet steel, it is also more resistant to corrosion. (5814)

• PILLOW BLOCK with molded rubber housing that eliminates noise and compensates for misalignment or shaft expansion should be especially suitable for air-conditioning equipment. (5815)



WELDING ELECTRODES now come in vacuum-packed cans to protect them from atmospheric conditions, keeping coatings fresh and preventing spalling. Containers are quickly opened with a key attached to one end, can be stacked in bins or piles. (5824)

• VESTPOCKET FLASHLIGHT has aluminum case for light weight. Bulb throws spot beam straight ahead, while plastic lens throws a diffused spread of light as well. (5816)

• WAGE RATES, the major factor in costs, must come down before prices can be reduced and business recovery begun, a booklet shows. The economist-authors lay rigidity of wage rates to government interference. (5817)

• RUBBER-BASE PAINT for interior and exterior use keeps moisture out, resists acids, alkalis, greases. Applied to wood, concrete, brick, or metal surfaces, it dries hard in an hour. (5818)

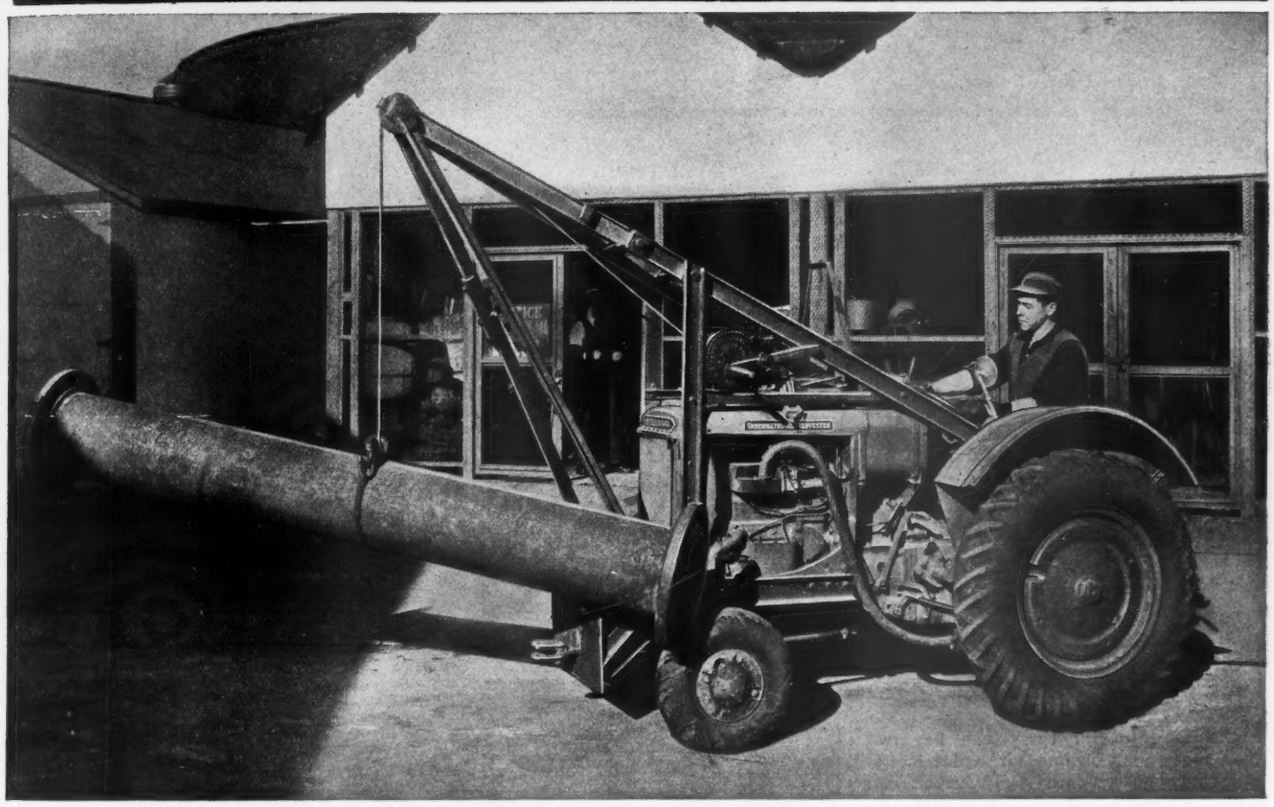
• TUBULAR LAMP is its own reflector. Side silvering on the inside concentrates light in a beam making a 45-deg. angle with the horizontal. Among its applications: machine and inspection bench lighting, desk lamps. (5819)

• OCCUPATIONAL DISEASE must be combated by practical engineering measures. First two of a series of bulletins showing how are just out. (5820)

• STAIR TREADS, ramps, and flooring made from safety metal are non-skid under all conditions. Electric-furnace abrasive grains are bonded into cast iron, bronze, aluminum, or nickel silver at time of casting. (5821)

• TWO SPEECHES—"The Recession —What Can Be Done About It?" and "The American Incentive System of Industrial Production" warranted publication in booklet form. (5822)

SAVE with the ECONOMY of INTERNATIONAL POWER



The small, compact International I-12 Industrial Tractor working in the plant of the B. C. Sugar Refinery, Vancouver, Canada. This tractor has the reputation for doing a lot of work and using only about a gallon of gasoline an hour on the job.

When costs pinch profits, look to your *power* and your *power work methods.* Many business men have swept away serious handicaps by scrapping obsolete equipment and methods and re-equipping with International Power. If you say the word, an International Harvester representative will go over your power needs with you and make recommendations that can easily save you many dollars.

International Power (gasoline, Diesel, and gas) is available to industry in four distinct forms: (1) Power Units, (2) Crawler Tractors (TracTracTors), (3) Wheel Tractors, and (4) Modified Units. Each type is built in a wide range of sizes, permitting the choice of the proper power and capacity for each job. The Modified Units are supplied to equipment manufacturers only, and are always sold as integral parts of high-grade equipment.

When in need of power or power-operated equipment, look for the International Harvester nameplate—it is your assurance of full power, high quality, and adequate service. International dealers and Company-owned branches have had a great deal of experience with heavy-duty equipment. They know the service needs of machines that do the world's hard work and are equipped to back up every sale to the user's complete satisfaction. Complete information on any type of power equipment will be sent on request.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL Industrial Power

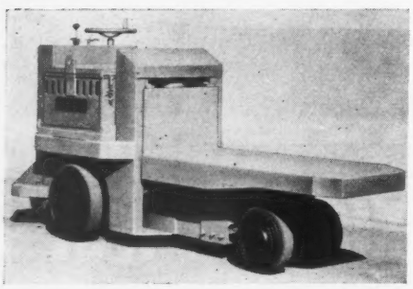
What's New in Equipment

Extension Spray Gun

Extension arm for spray gun has two brass tubes that fit into air and material connections of standard gun. Can be had in 6-, 8-, or 10-ft. lengths. Binks Mfg. Co., 3114–40 Carroll Ave., Chicago.

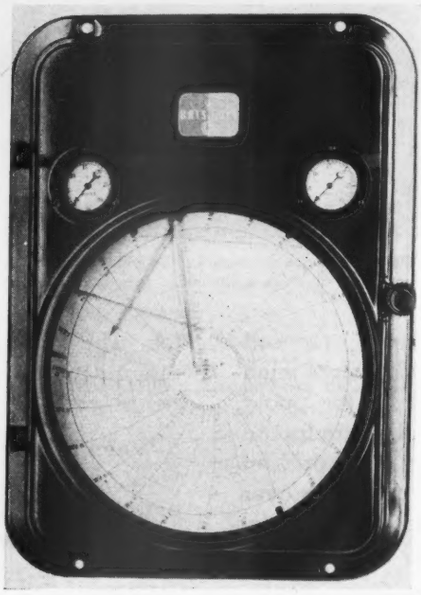
Truck

Model A-1020-28 low-lift elevating platform truck has capacity of 6000 lb., platform 27 in. wide by 66 in. long. Lowers to a minimum of 18 in. and raises to a maximum height of 24 in. above the ground. Drive axle is of double-reduction, spiral bevel and spur gear type. Steering is of the horizontal-wheel type. Mercury snap-action contactor controller provides three travel speeds forward and reverse. Platform elevation is done hydraulically. Battery power assembly is housed in a demountable box compartment. Truck will accommodate either battery box compartment or gas-electric unit. Trail axle wheels are size 15x5 in. rubber-tired, and drive wheels are 20x5 in. rubber-tired. The Mercury Mfg. Co., 4118 South Halstead St., Chicago.



Controller

Control instrument has wide throttling range and automatic reset. Adaptable to various types of continuous processes which involve control of temperature, pressure, vacuum, flow, and liquid level. Any load change accompanied by a movement of the pen away from the control point produces a change in the controlled air pressure of sufficient value to give the diaphragm control valve the required opening to bring variable back to the control point. Design of the reset mechanism makes it possible to obtain the change automatically, at a rate that corresponds to that required by the particular process being controlled. The Bristol Co., Waterbury, Conn.

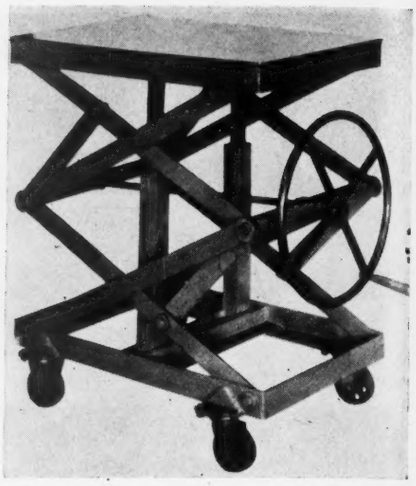


Belt

Thermoid V belts are of a special construction which gives a shock-absorbing action and is said to eliminate practically all belt stretch. High-tensile cords and wear-resisting cover are used in its construction. Thermoid Co.. Trenton, N. J.

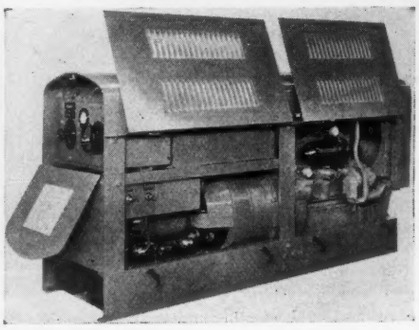
Elevating Table

Portable elevating table is constructed of steel and has top made from 3/16-in. plate, turned down around the edges. Cross levers are pivoted at each corner of the top and base, and on two square bars halfway between the top and base. By turning a handwheel the cross levers are moved toward or away from each other to raise or lower the table. In lowest position



the top is 26 in. from the floor; at highest, 43 in. The table is designed to carry a load of one ton safely. Equipped with ball-bearing casters 4 in. in diameter. Industrial Sheet Metal Works Co., 419 North Tenth St., Milwaukee.

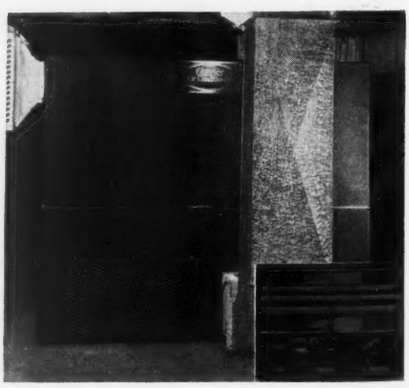
Welder

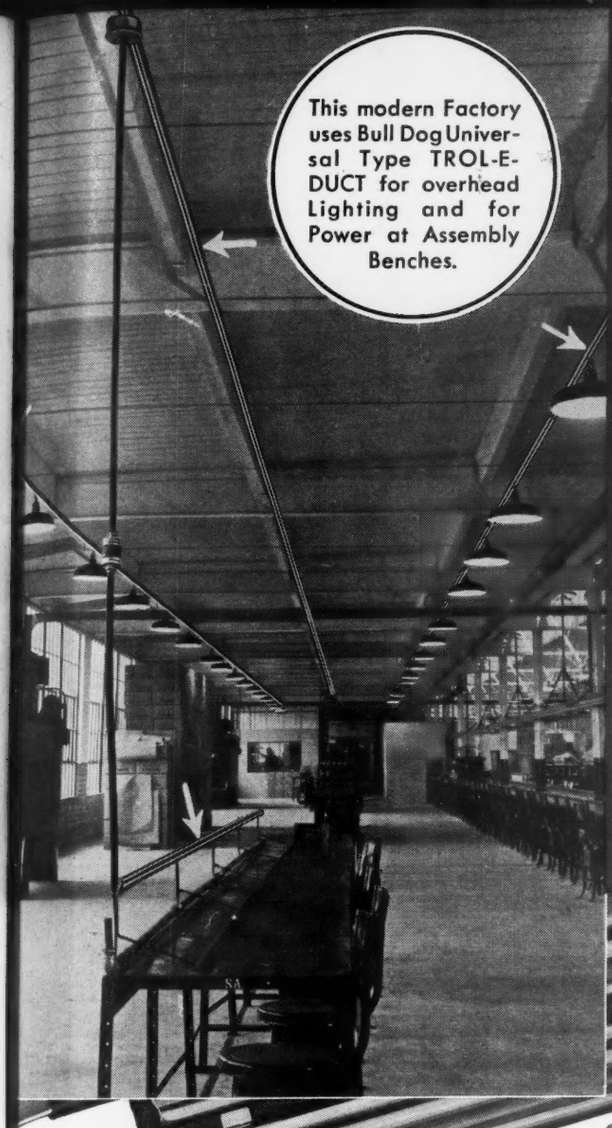


Diesel-engine-driven arc welder combines a new diesel engine with the company's 300-amp. "Shield-Arc SAE" welding unit. The engine is said to compare favorably with gasoline engines in simplicity, weight, cost, and operating speed. Welding generator is equipped with dual-continuous control which provides the right size and type of arc for every application. The Lincoln Electric Co., Cleveland.

Dehumidifier

"Carrier Dehydrator" is a dehumidifier of the silica gel type. Four sizes ranging in capacity from 600 to 5,000 cu.ft. per min. Moisture-removal capacity ranges from 25 to 210 lb. per hr., based on an entering wet





This modern Factory uses Bull Dog Universal Type TROL-E-DUCT for overhead Lighting and for Power at Assembly Benches.

Get the Advantages of *MOBILE* or *SEMI-FIXED* Light and Power Circuits with BULL·DOG

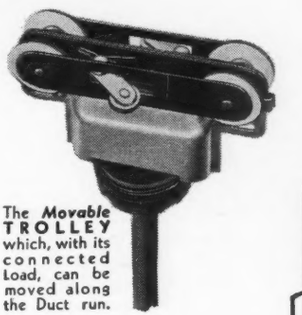
Trol-E-Duct

UNIVERSAL TYPE

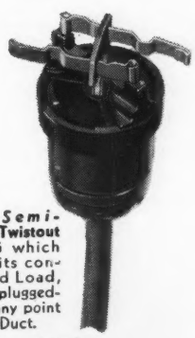
A Slotted Electrical Duct With *MOVABLE* TROLLEY and *SEMI-FIXED* PLUG-IN DEVICES . .

THE SLOTTED ELECTRICAL DUCT . . . EVERY INCH A POTENTIAL OUTLET

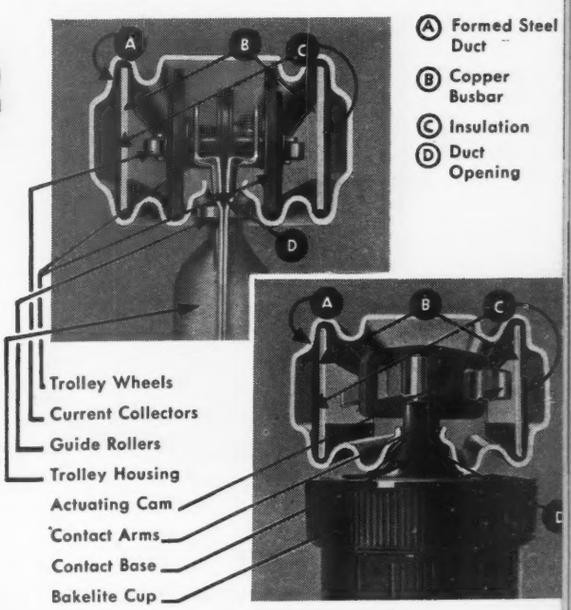
Below . . . *Left*—Cross sectional view of Movable TROLLEY inserted in Duct. *Right*—Cross sectional view of semi-fixed Twistout PLUG inserted in Duct.



The ***Movable* TROLLEY** which, with its connected Load, can be moved along the Duct run.



The ***Semi-Fixed* Twistout PLUG** which with its connected Load, can be plugged-in at any point in the Duct.



Ⓐ Formed Steel Duct
Ⓑ Copper Busbar
Ⓒ Insulation
Ⓓ Duct Opening

IF YOU WANT a Flexible Electrical Distribution System to which Moving Loads can be connected—or a system whereby you can readily bring the Load to a current source or a current source to the Load—or readily provide an Electrical Outlet where you want it, ***as quick as the wish for it*—INSTALL** Bull Dog Universal Type TROL-E-DUCT. Suitable for 10-Ft. or 10,000-Ft. installations.

ADEQUATE WIRING SERVES AND SAVES

Write For Illustrated Bulletin

BULL DOG ELECTRIC PRODUCTS COMPANY

Pioneers of Flexible Electrical Distribution Systems

DETROIT, MICHIGAN

BULL DOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO, ONT.

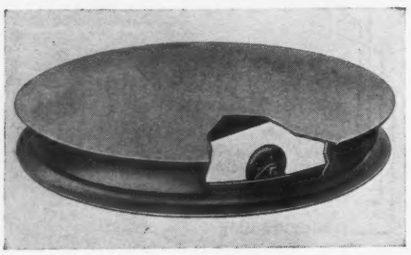
air condition of 9 grains per cu.ft. The smallest unit is 4 ft. 8 in. long, 2 ft. 3 in. wide, 3 ft. 9 in. high. Units can be used in multiple. Beds are reactivated by hot air entering through the top of unit and passing an air heater. Two dampers switch simultaneously to alternate two sets of beds in use. Carrier Corp., Syracuse, N. Y.

Tape Holder

Holder for friction or rubber tape is worn on the belt. Tape can be rolled off as needed without removing it from holder. It can be used down to the last inch without the rolls becoming so small that they are unhandy to use. Keeps the roll handy at all times and prevents its being lost. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Turntable

Turntable for use in a spray booth for rotating heavy objects in front of the operator. Turntable can be placed on floor of a bench-type booth or can be furnished with legs for use with a floor-type booth. Rollers make the table easy to turn. Can be had in sizes from 18 to 60 in. in diameter. Binks Mfg. Co., 3114–40 Carroll Ave., Chicago.



Draft Control

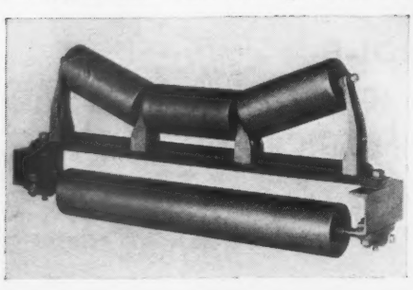
"Sequence Furnace Draft Control" prevents blow-back that occurs at ignition period in the on-and-off type of oil and gas burners and stokers. Control is electrically operated and is precisely timed so as to open the uptake damper wide an instant before burner or stoker comes on. In this way no pressure is built up in the combustion chamber and the ignition is accomplished without the usual explosion. Immediately following establishment of proper combustion the damper is closed to the position required to maintain good combustion, and from that point on the regular draft control maintains the draft. Hays Corp., Michigan City, Ind.

Ventilator

"Fan Roof Ventilator" uses the company's Type L fan with a non-overloading power characteristic. The fan cannot overload the motor under varying draft and pressure conditions. Motor is totally inclosed, and designed for vertical operation. Fan ring and motor are mounted on vibration dampers to eliminate noise and vibration. Unit is made in sizes ranging from 14 to 48 in. fan diameter. DeBothezat Ventilating Equipment Division, American Machine & Metals, Inc., Dept. O, 100 Sixth Ave., New York.

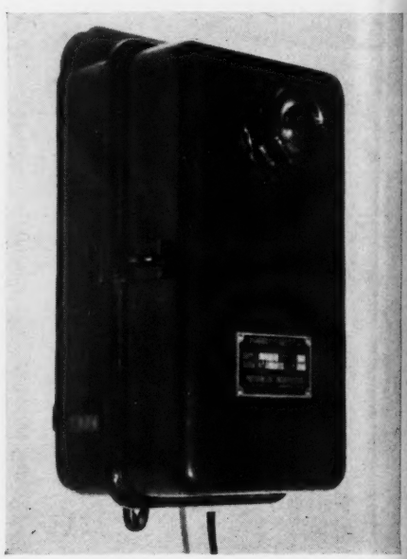
Conveyor Belt Idler

Ball-bearing belt idler for carrying moderate loads of semi- and non-abrasive materials is of 3-pulley, 20-degree, troughing type, made for belts 14, 16, 18, 20, 24, 30 and 36 in. wide. Ball bearings are of the commercial type with a cork seal within a pressed steel labyrinth dust cap. Pulleys are of 4-in. diameter welded steel pipe with formed steel gudgeons welded in the ends. Shafts of §-in. seamless tubing. As these shafts are hollow, the entire idler may be lubricated from either end through pressure fittings. The Jeffrey Mfg. Co., Columbus, Ohio.



Photoelectric Control

"Photoswitch" is a photoelectric control which is said to be quick operating and of rugged construction. Both control and light source are furnished in weatherproof housing suitable for installation in any location. Model A10 is used for most industrial applications. Operates on 115 volts a.c. or d.c. Model A 20 is used for long-distance signal systems and controls. It operates at a distance of 60 ft. from its light source, both in daylight and darkness. The Model C 30 Counter combines the control and counter in one unit. Photoswitch Incorporated, 21 Chestnut St., Cambridge, Mass.



Fixture Hangers

Electric fixture hangers for use in wiring and hanging industrial lighting units are flexible and contain a universal joint which allows the pendant to swing freely 18 deg. in any direction. Universal joint is so designed that regardless of slant of stem the connection with box itself is virtually dustproof. Two types: "ball" type and "cushion" type. The cushion type is simi-

A TIGHTER SEAL WITH LESS FRICTION?

SEA RINGS are "made to measure" to fit the individual stuffing box and of the correct composition for the particular service condition, whether steam, hot or cold water, air, brine or oil. Their action is completely automatic. The flexible lip is held tightly to the rod by the pressure on the work stroke, but releases on the return. Unnecessary friction is eliminated, less power is needed, there is less wear on both rod and packing. Sea Rings last longer and cause fewer shutdowns.

YES!

when you use

SEA RINGS

Sea Rings seal automatically on the work stroke . . . release on the return . . . Result: increased efficiency, longer life

INCREASED operating efficiency and less time lost for repacking . . . that is the record J-M Sea Rings have made in thousands of plants throughout the country. Three features explain their exceptional service—proper composition, correct design and rugged construction. And these same three features are characteristic of all packings in the complete J-M line.

Johns-Manville, largest manufacturer of asbestos products, is well equipped to make packings of unusual quality. J-M Packings are the result of 60 years' experience in the development of materials specifically suited to various mechanical-equipment and service conditions. No matter what your packing problem is . . . no matter how severe the service . . . there is a J-M Packing that can handle it efficiently, dependably and economically.

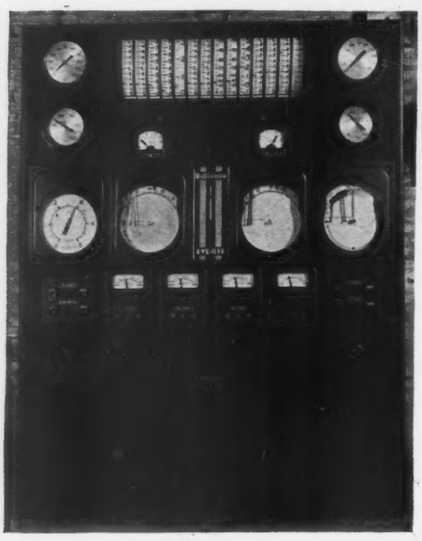
The J-M Packings Catalog will help you select the right packing for every requirement in your plant. For your copy, write Johns-Manville, 22 East 40th Street, New York City.

JM JOHNS-MANVILLE PACKINGS & GASKETS

AVAILABLE ON PHONE CALL AT YOUR NEAREST DISTRIBUTOR

lar to the ball type but contains a spring or cushion that completely supports the fixture. Bodies are made of malleable iron which may be plated, galvanized, or enameled. Malleable iron suspending hook contains a wired receptacle. Hook body screws into the pivot outlet. Thomas & Betts Co., Elizabeth, N. J.

Combustion Control



Automatic combustion control mounts all instrument controls on a single, centralized panel. Four main units consist of master control connected to the steam header and receiving impulses from variations in steam header pressure, airflow control, fuel-feed control, and furnace-draft control. System is completely electrified and the mercury switches used are totally enclosed. System is of the metering type measuring the variable elements that the system controls as well as the corrections themselves. Hays Corp., Michigan City, Ind.

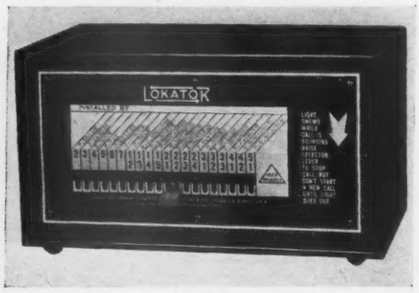
Paint Container

Quart aluminum paint container and cover for attaching to siphon-feed spray guns. Cover is a light-weight stamping which locks in any position on the circumference of the

aluminum container. The lip of the lock has a flange which fits over the rim of the container and seals against leakage with a fluid-resisting gasket. It will fit standard quart paint cans. This makes it possible for users to make changes in color without cleaning standard containers. The Alexander Milburn Co., 1493 West Baltimore St., Baltimore.

Communication System

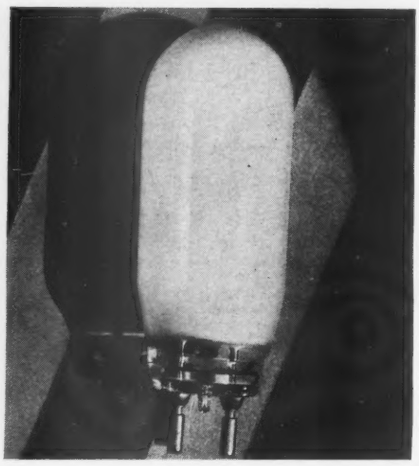
"Lokator" is an automatic communication system which operates by low voltage from standard lighting circuits. Its mechanism is driven by a small synchronous motor. It is a call system, and a variety of signals



can be supplied for use on it. On the smallest model, 20 different people may be called. Names of individuals are put on the face of the unit switchboard and the selector lever slides beneath to name of individual wanted. Slight downward pressure sets the call going. Code continues to sound until the lever is switched back to normal position. Edwards and Company, Inc., Norwalk, Conn.

Lamp

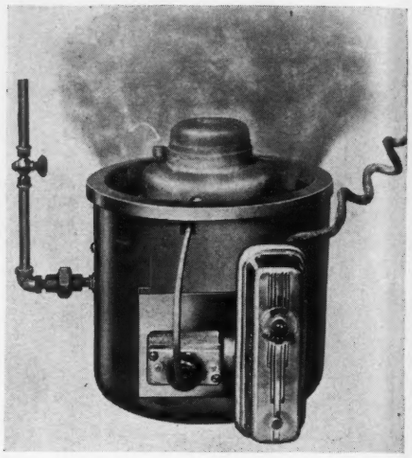
Bi-post lamp of 500-watt capacity is designed to fill the need for a high-wattage light source of extremely small size. Inside frosted, it is said to give more light throughout the life than the screw-base lamp of corresponding wattage. Can be burned base



down or base up. Claimed to have high maintenance of light output because of two screen grids, one of which is placed above the filament and the other below. These grids intercept volatile tungsten particles which would otherwise settle on inner walls of the bulb. Base consists of two metal posts which are continuation of loads supporting the filament. Light center length is 4 in.; maximum overall length 7½ in.; diameter 2½ in. General Electric Co., Nela Park, Cleveland.

Humidifier

Automatic humidifier has capacity of 1½ pints per hour. Mounted inside the spun-copper bowl is a waterproof motor which drives the mechanism to break water into finely divided mist and mixes it with sufficient air to complete vaporization. The bowl measures 13½ in. in diameter by 11½ in. high, and complete unit weighs 35 lb. Can be placed on table or suspended from wall or ceiling. Water is supplied through a small connection in the side of the bowl, the connection being equipped with a brass float-valve. A humidity control with a working range of 10 to 85 per cent at temperatures from 40 to 150 deg. F. operates the unit. It is wired for 110 volts, 60 cycles, a.c. Cugley Incubator Co., 660 Beardsley Ave., Elkhart, Ind.

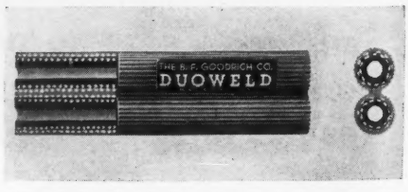


Paint

Valdura Mill White Paints are said to be formulated for maximum whiteness and permanent resistance to yellowing action of fumes and vapors. Three finishes—flat, eggshell, and gloss. For unusually severe conditions there is a special fume-resisting white which dries in 4 hours. American Asphalt Paint Co., 43 East Ohio St., Chicago.

Oxy-Acetylene Hose

"Duoweld" oxy-acetylene hose consists of two strands of ¼-in., 2-braid hose with corrugated cover, with strands molded together in a single unit. The cover on one strand is red, on the other green. Dual construction prevents two lengths from becoming tangled, and eliminates kinking. Offered in 12½-, 25-, and 50-ft. lengths. Each length is separated and secured with metal fer-

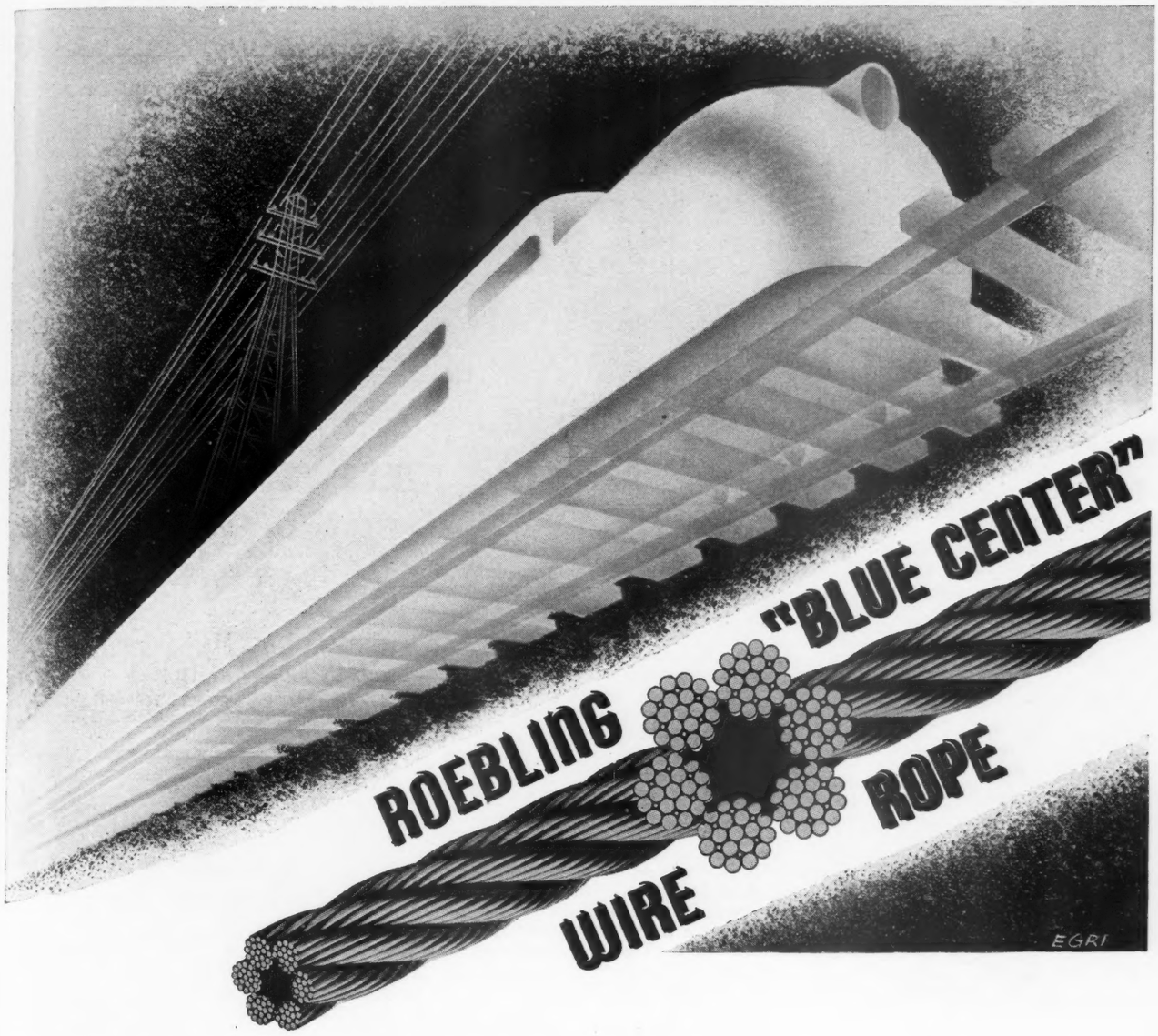


rules about a foot and a half from the ends for easy attachment to equipment. The B. F. Goodrich Co., Akron, Ohio.

Separator

"Hager Separator" removes water, oil, dirt, etc., from compressed air, gas, or steam lines. Operates on principle of centrifugal action by means of three-vane units through which the air, gas, or steam must travel in succession. Each of these units sets up a rapid whirling movement which throws moisture and dirt outward from the center. Flow from outlet is clean

AS ADVANCED AS TODAY'S STREAMLINERS!



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BRANCHES IN PRINCIPAL CITIES

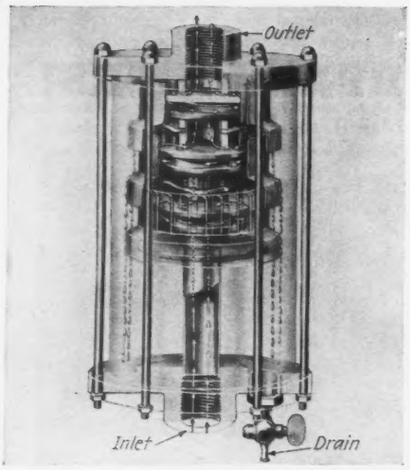
STRONGER—Wire of highest strength consistent with ductility and toughness

TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

SAFER—Unequalled for uniformity of quality

SAVING—Insures lowest general average operating cost

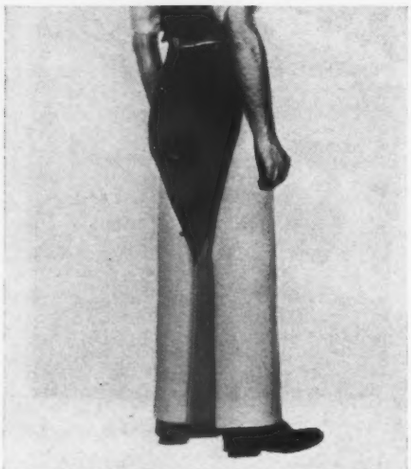
THE HIGHEST DEVELOPMENT IN ROEBLING WIRE ROPE



and dry. Separator measures 10½ in. high by 6 in. in diameter, and weighs 15½ lb. Suitable for pipe sizes to ¾ in. There is no wear, because cleaning units remain stationary and metals used are rustproof and acid-resisting. Textite Corp., 2110 Roscoe St., Chicago.

Welder's Chaps

No. 11508 welder's chaps cover the entire front of the body from waist to foot and are open in the back for coolness and



light weight. They have an adjustable webbing belt. They may also be had with bib apron of chrome leather attached. Worn over regular clothing. Industrial Gloves Co., 714 Garfield Blvd., Danville, Ill.

Motor

Type RT polyphase motor has low starting current, high starting torque, and good speed regulation. It has a locked torque

of about twice full load torque and a locked current of from three to three and one-half times full load current. Motor is controlled by a magnetic starter containing two contactors. Available in a large variety of ratings, but will ordinarily be built only in sizes 40 hp. and larger. Is especially adapted to air-conditioning service. Wagner Electric Corp., 6440 Plymouth Ave., St. Louis, Mo.

Insulation Stripper

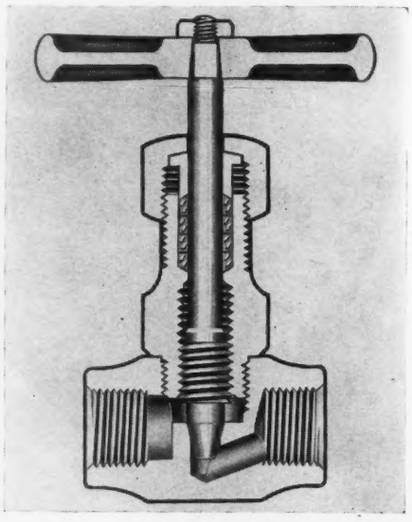
"Cable Ripper" rips insulation from nonmetallic, sheathed duplex cable or lead-covered cable in one motion without danger of cutting the wires. It is squeezed onto the cable and pulled, ripping cleanly and accurately without gouging. Can be used for ripping outer sheathing of other cords where outside diameter is ⅝ in. or smaller. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Lubricator

"Sutton Oiler" delivers under pressure the exact amount of oil required—1, 2, or 3 drops at a time. The flexible delivery tube may be bent to oil conveniently the most inaccessible part. Adjustment nut makes possible the exact regulation of the amount of lubricant. There are no check valves. Operates with positive piston action. Sutton Tool Co., Wilkinsonville, Mass.

Valves

Three plug-type disk, globe, and angle valves have bodies and bonnets made from solid bar stock. Are said to be well adapted where accurate regulation of flow is desired, or where parts of measuring instruments must be protected against sudden release of high pressures. All may be packed when wide open and under pressure. Come in steel, Exelloy, or 18–8 chrome nickel alloy. No. 222½ globe valve is



made with male and female ends in sizes ⅛ to ¾ inches. No. 222 is ⅛-in. size and No. 223 1-in. size, both with female ends. Crane Co., 836 South Michigan Ave., Chicago.

Mask

IPCO Nitrometer-Acid Mask is used to protect eyes and face from splashes of acids or alkalis and other substances. Manufac-

tured of sheet aluminum, it is light and comfortable, and has a 7x9-in. cellulose acetate window. Has headgear of vulcanized fiber which is adjustable to various head sizes. Friction hinge joints permit the wearer to raise mask over the head when not exposed to the hazard. Industrial Products Co., 2795 North 8th St., Philadelphia.

Sheaves

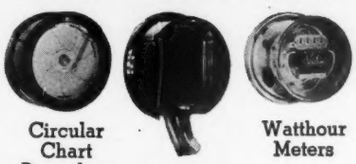
Two - groove, adjustable - pitch - diameter, texsteel sheaves provide speed variation up to 33 per cent on any driven unit. Can be applied where required load does not exceed 3 hp. Available in three sizes: 2 to 3 in., 2.5 to 3.5 in. and 3.5 to 4 in. Pitch diame-

THIS LOW-COST SOCKET MAKES INSTRUMENT USE EASY · PRACTICAL · PROFITABLE

COMPLETE LINE OF INSTRUMENTS TO FIT . . .

There is a complete line of low-cost socket instruments to fit Westinghouse Type "S" sockets.

Ammeters Wattmeters Voltmeters



Circular Chart Recorders

Test Jack

Watthour Meters

Type "S" meter sockets — for five years the standard watthour meter mounting — now make instrument use as simple and convenient as plugging an electrical appliance into a home convenience outlet. No wiring connections to make — no production losses from circuit interruptions during tests.

Westinghouse Sockets are easily installed in the conduit, giving instant access to valuable power and machine performance facts. Send today for full information about this new key to lower cost maintenance, improved production control, and reduced power costs. Westinghouse Electric & Manufacturing Company, Department 7N, East Pittsburgh, Pennsylvania.

Send for Booklet B-2136 — "Socket Instruments"—explaining how to gain instant access to valuable facts at lower cost than ever before.

J-40145

METERS INSTRUMENTS RELAYS

Westinghouse

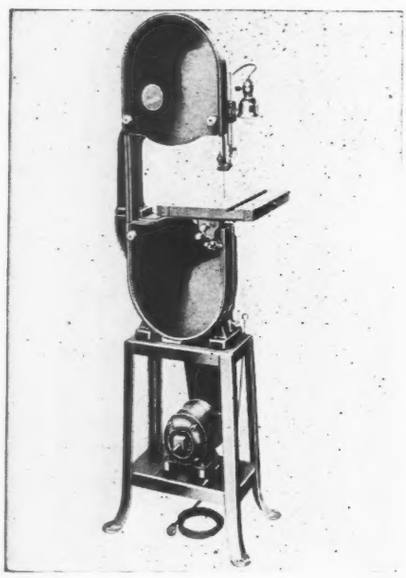
ELECTRICAL INSTRUMENTS

"The Standard of Accuracy Since 1888"

ters can be changed in a moment by releasing the head locking screw and turning the adjustable plate in or out to desired pitch diameter. The company has also added an intermediate-diameter sheave to its single-groove series. This also has a speed variation of 33 per cent for ratings up to 1½ hp. Allis-Chalmers Mfg. Co., Milwaukee.

Bandsaw

Metal-cutting bandsaw will cut materials up to 6 in. thick. With an extension, capacity under the guide can be increased to 12 in. Has five speeds: four for metal, of 125, 175, 250, and 340 f.p.m., and one for wood of 2,200 f.p.m. Slow speeds are obtained through a ball-bearing gear box, and the wood speed is obtained direct from the motor by a V-belt drive. Self-sealed ball bearings are used throughout, eliminating necessity for lubrication. Delta Mfg. Co., 600 East Vienna Ave., Milwaukee.

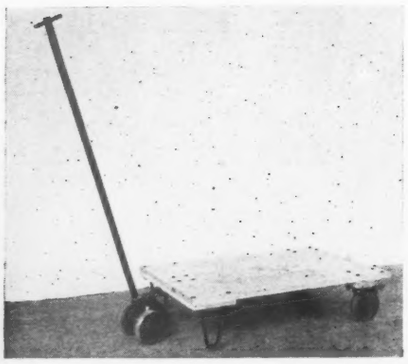


Resistance Tester

"DM Megohmer" is an instrument for insulation resistance measurement. An older instrument has been redesigned so that this model may also be used as a portable a.c. and d.c. voltmeter with a range of 600 volts. Herman H. Sticht & Co., 27 Park Place, New York.

Lift Truck

"Lift Jack Platform Truck" consists of skid platform and jack. Skid has two wheels in the rear and two steel legs in the



front. Jack is moved under the front, the handle pulled down, and the skid lifted off the front legs. To move jack it is only necessary to move the handle and roll it out. Skid is made of ¾-in. oak. Can be furnished in various sizes and types of iron wheels and bearings, or with rubber-tired wheels. The Fairbanks Co., 393 Lafayette St., New York.

Metal Marker

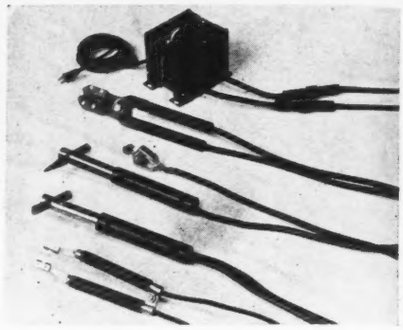
"Safety Wedge Grip Radius Holder" is an interchangeable type holder for stamping round or curved surfaces such as pipe or shafts. It contains removable slide that holds the type. Only one holder is required for various radii, but it is necessary to have individual slides and corresponding types for each radius. Sides of the holder are knurled to give operator firm grip. The head of the holder will not mushroom or spall in service. M. E. Cunningham Co., 152 East Carson St., Pittsburgh.

Dispensing Rack

Combination hoist and dispensing rack for barrels and drums. Only one man is needed to roll drum to position for hoisting, and to turn the crank to raise drum to horizontal position. Of steel construction, it is capable of handling loaded drums or barrels up to 600 lb. Has one-way rollers which do not operate when rack is loaded. Revere Electric Co., 757 West Jackson Blvd., Chicago.

Soldering Unit

"Deluxe" Thermo-Grip soldering unit operates electrically for all types of soft soldering work. It consists of a transformer and four heads or tools. Operates on any a.c. supply. All current-carrying parts are insulated. The four heads are designed to be used in handling different-size pieces. On soldering jobs where speed is particularly necessary a foot-operated switch is available. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.



Portable Potentiometer

Portable potentiometer, when used with thermocouples, becomes a checking instrument of high velocity and sensitivity. Three models: Model 310 has cold junction compensator; Model 320 has cold junction compensator and run-up box; Model 330 has cold junction compensator, run-up box, and

standard thermocouple line compensating rheostat. Standardized with regulation standard cell, and is equipped with precision slide wires and multipliers. Galvanometer is of regulation dual taut suspension type, complete with lock and zero adjuster. Scales calibrated in millivolts or in degrees Fahrenheit or Centigrade, or both. Wheelco Instruments Co., 1933 South Halsted St., Chicago.

Centrifugal Pumps

Self-priming centrifugal pumps have a check valve built into the suction that holds the prime in the pump and suction line, ready to pump as soon as the pump starts operating. Priming operation is completely automatic. Impeller is the semi-inclosed, non-clogging type, designed to pass the usual

This dispenser, and Morton Salt Tablets, represent the most sanitary, economical, and convenient method yet perfected to supply salt to employees. Dirty fingers cannot mark the polished alumilite surface of Morton's dispenser nor can dust or grit collect inside. A special, corrosive-free metal interior keeps tablets snugly dry and a simple push of the lever at the base dispenses tablets, one at a time, without breaking or crumbling. Transparent slot indicates when refill is necessary. Order now — help protect your workers against Heat-Fag.

DISPENSER $4.50

CASE OF 9,000 — 10 GRAIN MORTON TABLETS $3.15 *Sent Prepaid*

PENNIES INVESTED— DOLLARS RETURNED

*HEAT-FAG—that unseen, strength-sapping force that attacks workers and withers production and profits

Protect your workers — maintain production efficiency and profits! Install Morton Dispensers where all of your employees can conveniently take salt tablets.

Men who sweat *need* salt. The human body, when overheated, cools itself by perspiration. As we perspire, we lose salt and water—and when too much is lost, salt must be replaced or heat-fag results. Otherwise, lack of efficiency and lowered production and profits inevitably follow.

Time and again, this has been established *as a fact* by medical research and practical test in some of the country's leading industries. No wonder, then, that alert, forward-looking executives have insisted that their workers be supplied salt in a convenient, easy-to-take form . . . and that the Morton Dispenser and Morton Salt Tablets are destined to become a fixture throughout American industry. The cost is so small—and the benefits so great, that such is a foregone conclusion.

Only the purest and most highly refined Salt is used in Morton Salt Tablets.

Write for illustrated bulletin "Heat-Fag" for interesting facts on the value and importance of salt to your workers.

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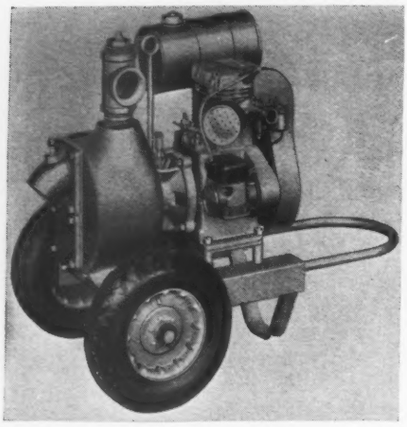
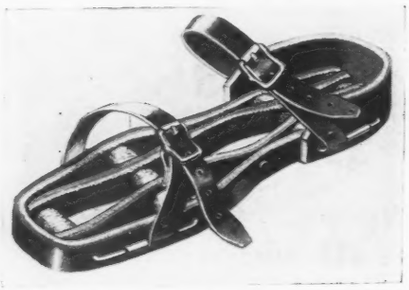
MORTON SALT COMPANY
CHICAGO, ILLINOIS



solids encountered in de-watering work. A shaft seal prevents air from entering the pump case during the priming operation and during pumping. Available in electric motor and belt-driven units as well as gasoline engine driven. Range of 16 capacities from 10 to 300 g.p.m. Gasoline engine units are portable. Another portable model, known as the "Light-Weight" is equipped with carrying handle, weighs only 55 lb., and can be easily carried by one man. The Deming Co., Salem, Ohio.

Undershoes



"Easies" are undershoes designed to provide insulation from cold, wet, and hard floors. Not cumbersome, they provide sure footing on slippery, wet floors. Made of ½-in., heavy, rubber-impregnated cord, bound together with rust-resistant steel links. W. H. Long Co., 101 West Austin Ave., Chicago.

Communicating System

System 305-7 is a 7-watt combination paging and interoffice communicating system. Amplifier is separate from desk master unit. It is said to have high talk-back sensitivity, so that a person addressed can reply while standing several feet from the speaker. The Webster Co., 5622 Bloomingdale Ave., Chicago.

Lift Truck

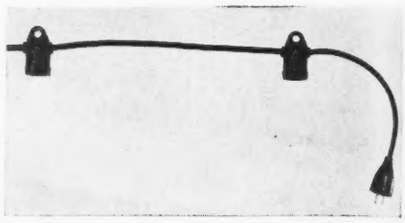
Hand lift truck handles piles of loaded tote pans. A pile of four or five pans may be straddled by this truck, the lifting frame elevated, thus raising the entire load and tilting it for safe riding. There is a counterweight to prevent tipping—a tilted backrest —and forks extending from upper rails. Capacity is 1,000 lb. Forks are 10 in. long. Wheels are rubber-tired, and ball bearings are used. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.

Welder's Helmets

One-piece seamless and rivetless welder's helmets and handshields are equipped with Noviweld glass which provides protection against glare, ultra-violet and infra-red. Features of the various models include non-slip handles, modern plate holders, improved headgear and pads, lift-front lens handles. The lift-front lens makes possible rapid inspection of the work without removing helmet. American Optical Co., Southbridge, Mass.

Light Cord

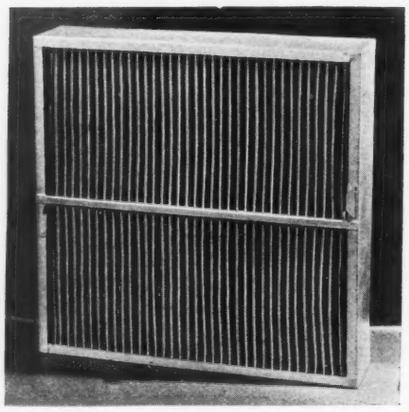
"C & E Stringlite" is a permanent cord for temporary uses. It can be used over and over again without dangers common to most temporary lighting. Made completely of rubber, and insulated, it is said to be free of broken wires, frayed insulation,



short circuits, or grounds. Easily put up and taken down, as it is only necessary to hang it over any projecting object, timber, or nails. Comes in 50-ft. lengths with 5 socket outlets. The Ericson Mfg. Co., 5716 Euclid Ave., Cleveland.

Air Filter

"Wire-Klad" filter is a dry-type air filter which has the desirable feature of flame resistance. Wire mesh reinforces the fin-type filtering medium so that the filter can be cleaned by high-pressure air or vacuum. Several kinds of filtering media are available. If cleaning with a solvent is necessary, the filter insert can be removed from the frame. Standard and special sizes are available. Three standard depths are 2, 4, and 6 in.; four standard sizes are 20x20, 16x20, 16x25, 20x25 in. Staynew Filter Corp., Rochester, N. Y.



Hoist

"Safety Pull" hoist has safety features. Its pushbutton control is operated when load has been elevated and hoist is to be lowered. Pushing the button reverses the action. This control also acts as a safety stop; if the operator's hand should slip off the handle, this device automatically and positively locks the handle before it can revolve. Two other safety stops prevent handle from whirling around and causing injury to operator. Pawl can be stopped and locked in

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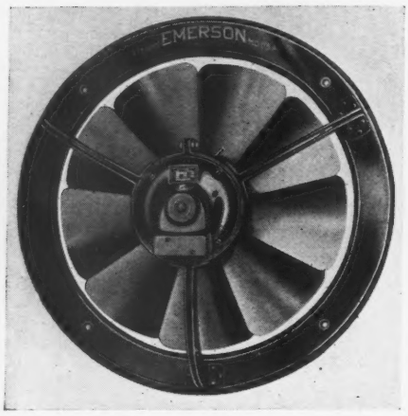
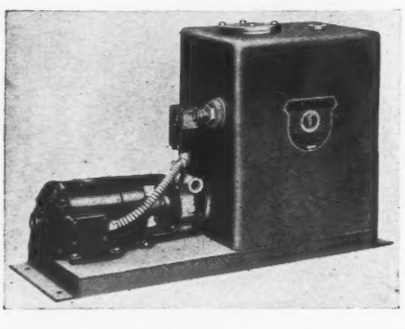
position at half the length of the regular stroke. In case of overloads, the handle bends before any other part of the hoist will give. This serves as a warning to prevent chain from breaking or hooks from straightening out and dropping load. Made for loads from ¾ to 15 tons, weighing from 14 to 150 lb. Each hoist is factory tested to lift 100 per cent overload. Coffing Hoist Co., Danville, Ill.

Exhaust Fans



Single-speed, sleeve-bearing exhaust fans have heavy-duty, fully-enclosed, self-cooling motor; wool-packed oversize bronze bearings, for continuous operation with only occasional lubrication; nine overlapping steel blades. Designed for installation with motor shaft in horizontal position. Five sizes: 12, 16, 18, 24, and 30 in. Operate from single-phase, 110 volts, 60 cycles. The Emerson Electric Mfg. Co., St. Louis, Mo.

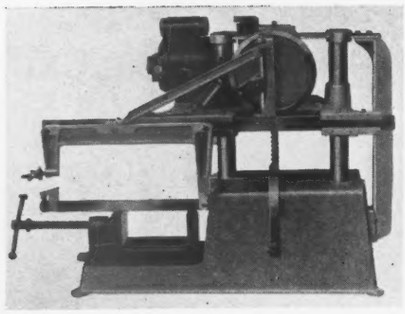
Condensation Return Pump



"Hot Shot" condensation return pump is a close-coupled design, using for its operating unit the company's "Motopump" with balanced bronze impeller, mounted on a rustproof steel motor shaft. It has sealed, grease-lubricated ball bearings and special shaft seal. Receiver is welded copper-bearing steel, steam tight. The switch is mounted on a screw-in connection through which the whole mechanism can be removed. Unit comes complete, ready for pipe and electrical connections. Yeomans Brothers Co., 1433 Dayton St., Chicago.

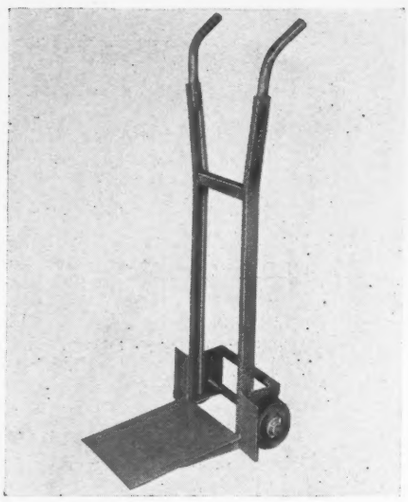
Portable Hacksaw Machine

Portable hacksaw machine has movement that automatically determines the exact pressure required to cut any degree of hardness in metals, and will hold the saw in any position without danger of its falling.



No oil, grease, or liquid is required at blade contact. High speed of operation is possible without overheating the saw blade or stock. Will cut round or square stock up to 7 in. in diameter and up to 5-in. stock can be cut at a 45-deg. angle by the simple adjustment of the vise. Equipped with either a ½-hp. electric motor operating from 110-220 volts a.c. or d.c., or a ½-hp. gasoline motor. Master Machine Co., 872 West North Ave., Chicago.

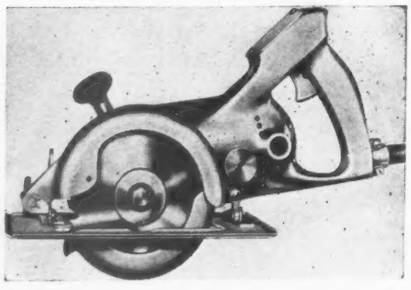
Scoop Truck



All-steel scoop truck handles any type of crate, case, tote box, barrel or other container. Designed so that the load is directly on the wheels and axle and not on the trucker's arms. It is 19¼ in. wide overall with height of 53 in. Wheel diameter is 6 in.; wheels are equipped with roller bearings. Barrett-Cravens Co., 3255 West 30th St., Chicago.

Trim Saw

No. 35 electric trim saw weighs 11¾ lb., and is said to be very easy to handle. It can be used for light crating jobs and general saw work where 1⅜ in. is the maximum vertical cut required. Saw blade is



5 in. in diameter. No-load speed is 4,200 r.p.m., full-load 2,800 r.p.m. Overall length is 14 in. Universal motor operates from 110 volts; also available for 220 or 250 volts. The Van Dorn Electric Tool Co., Towson, Md.

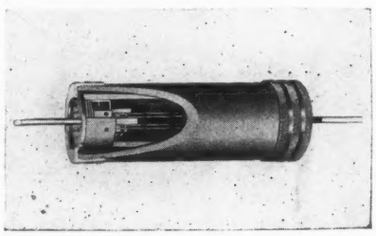
Oil Seal

"Split-Klozure" oil seal is split or cut open so that it can be applied by placing it around the shaft instead of sliding it over the end. Consists of a cut-open composition sealing element or packing ring molded into a cross-sectional shape resembling a

modified V, to which is bonded, under pressure, a finger-type spring. The sealing element and spring thus are combined into one piece; they are handled as a single unit. Available in any shaft size from 3 to 52 in. in diameter. The Garlock Packing Co., Palmyra, N. Y.

Renewable Fuses

These renewable fuses are constructed with small holes through the ends of the fuse case so that air can circulate. This is to prevent fuses from heating up. To pre-



vent flames from escaping in case of a blow, both ends of the fuse are equipped with fine mesh screens. The cooler operation is said to assure longer life of both case and the renewable links The design is simple so that when a fuse blows it can be renewed quickly. Pierce Renewable Fuses, Inc., Buffalo, N. Y.

Welding Electrodes

Line of shielded-arc welding electrodes that are claimed to be quieter in operation, faster in welding time, produce finer bead appearance, and have great adaptability.

. . this is the FILE for me

Bite-Rite triumphs. Tests in actual use, with brand names of files hidden. Time and again Bite-Rite Files selected as different, better.

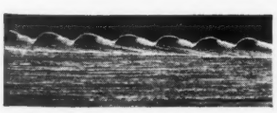
for faster, smoother work

Staggered teeth cut, level, and smooth at one stroke. Disston Bite-Rite File combines speed, long life and smoothness of filed surface. Disston engineering developed a sturdy, sharp tooth with correct contour cutting tip. Proper support at back. Rugged shoulders between teeth.

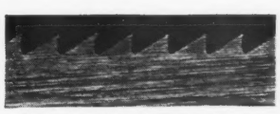
Combined with this is the Disston-designed non-clogging gullet. Round, smooth, open. Cuts heavy, long, curling chips from metal with fewer strokes. Like chips from a lathe tool.

Every stroke with a Disston Bite-Rite File takes off more metal. Finished work is cleaner, smoother, done faster, as the file cleans itself after every cut. See and feel the difference when you work with this *different* file. Made by Henry Disston & Sons, Inc., Philadelphia, U. S. A.

For sample files, write Distributor of Disston Bite-Rite Files.



Smooth Filing. Bite-Rite teeth. Sturdy, sharp, durable, well-supported.



Non-clogging Gullet. Round, smooth, open. Free, clear, clean discharge of chips.

New Fast Speed. Disston Bite-Rite File produces long, curling chips. Fewer strokes; faster filing.

DIFFERENT

See how Bite-Rite teeth are staggered to cut, level, and smooth at each stroke.

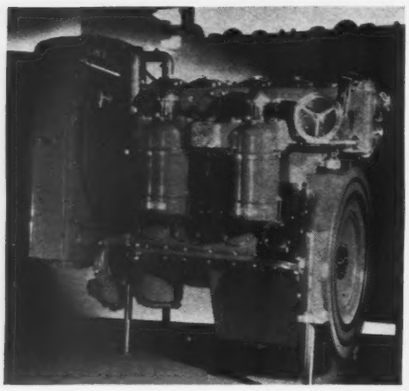
Work's-eye view—looking into Cutting Face of Bite-Rite File.

BITE-RITE

NEW DISSTON FILE

Line includes all-position, flat-position and fillet, general purpose fillet, and light sheet metal electrodes; also electrodes for a.c. transformer welding machines. Range of sizes is 3/32 to ⅜ in. in most cases; lengths 11½ to 14, and 18 in. The McKay Co., McKay Bldg., Pittsburgh.

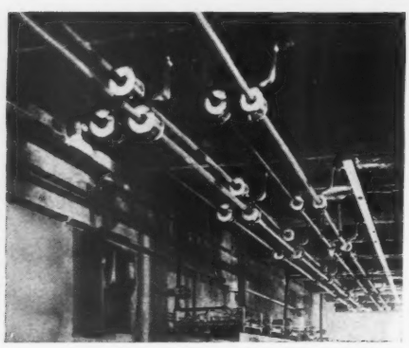
Diesel Engines



Four-cylinder diesel engines develop 100 hp. on continuous load. Single control wheel acts as a throttle as well as operating a simple gasoline starting mechanism. If oil pressure fails, engine stops. Each cylinder has complete independent injection unit mounted at the center of the cylinder head and driven directly by overhead camshafts. Fuel is filtered and supplied at low pressure, and metering is accomplished by the fuel injector. The Murphy Diesel Co., Ltd., Milwaukee.

Conductor Rack

Type U nested conductor rack for carrying electrical lighting or power conductors is designed to space the wiring or cable equidistant from center to center. Large, heavy, glazed porcelain bushings are supported by



only one belt which, at the same time, clamps bushing support to the rack. Each fitting is a separate unit and permits the installation of each line of cable independently. Racks are designed in five separate units to carry from two to six conductors. Made of standard, rolled steel channel, in sizes varying according to size of bushings and number of mountings. Bushing supports are of malleable iron. Efficiency Electric & Mfg. Co., East Palestine, Ohio.

Revolving Welding Table

Revolving table for mounting welding jobs is 31 in. in diameter and 25 in. high when horizontal. It has eight lines of radial slots for bolting work to it. Tilted by hand-operated self-locking worm and wheel. Tilts to a vertical position either side of the center line and in this position will carry a load of 600 lb. with a maximum diameter of 34 in. Work of larger diameter can be carried in a vertical position on one side of center. Table driven by ¼-hp. motor driving through a variable-speed transmission and worm gear reducer. Range of table speed can be varied to correspond to welding speed. Speed is adjusted by handwheel on the side of the housing. Drive is reversible. For quick positioning the table can be instantly disconnected from the driving mechanism. Ransome Concrete Machinery Co., Dunellen, N. J.

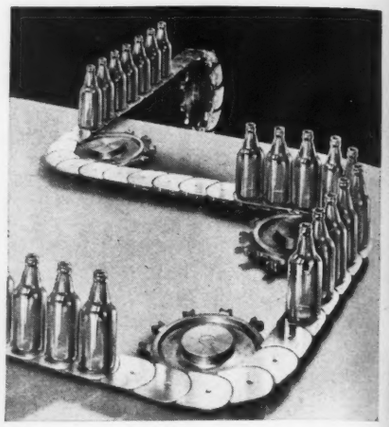
Reflector

No. 682 "Lobay" reflector takes a 300- and 500-watt lamp. It is a wide-spread light completing the company's line of reflectors of this type, so that choice of a concentrating, intensive, or widespread light distribution from units similar in appearance, is now available. Prismatic reflectors, which determine the light distribution, are interchangeable in the same fixture part. Holophane Co., Inc., 342 Madison Ave., New York.

Timer

Synchronous process timer has one large, 24-hr. dial and a 1-hr. dial cam. Two pointers connected with an electrical contact arm ride each dial. Segments are cut in the 24-hr. dial at the periods signal is to operate. The 1-hr. dial cam has slots at each 15-min. period. When contact is made, a signal rings for a predetermined period. Four types are available: In Type P-24 time periods are set at the factory. Type P-524 is similar except time periods can be set or changed any time. Type P-24A is like P-24 except operating period of signal is adjustable from 1 to 15 sec. Type P-524A is similar to P-524, but has adjustable operating period of 1 to 15 sec. Zenith Electric Co., 607 South Dearborn St., Chicago.

Conveyor Chain



"Universal Carrier Chain" can operate in two planes, and is suited for handling bottles, jars, and cans in process of manufacture, and in cleaning, filling, and capping operations. The two-plane travel feature makes it practical to use this chain in rectangular, circular, semi-circular or irregular paths, and employ one long conveyor instead of several transfer conveyors. The chain moves in continuous, unbroken carrying surface of equal width, whether the chain is moving in a straight line or turning a sprocket wheel. Only one driving mechanism is required. Made of finished steel, and operates over cut-tooth sprocket wheels. Link-Belt Co., 519 North Holmes Ave., Indianapolis.

Fan

Propeller-type fan for use in dust systems, and for similar locations where resistance to air flow is encountered. Has non-overloading feature. Available in various sizes and horsepower ratings. Propellair, Inc., Springfield, Ohio.

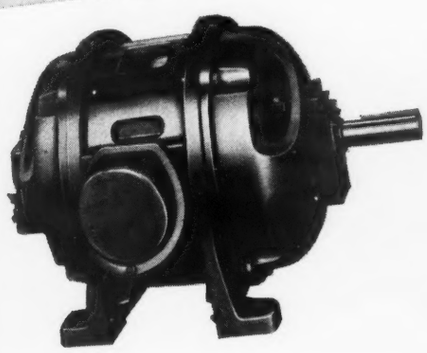
Burglar Alarm

"Teletouch Electric Eye Burglar Alarm" can be installed by simply plugging into an electric outlet. Can be mounted up to 50 ft. from light source. Alarm is started either when invisible light path is broken, or when power line is cut or plug pulled from outlet. The alarm, once started, can

And the most important is *Mileage*

Mileage! Here power is transmitted through a belt putting a severe strain on the motor. But the one-piece frame keeps bearings and air-gap in alignment, month after month, year after year.

Mileage! Note the cement dust to which this CS motor is exposed. It has driven this cement bucket conveyor for years without repair or replacement.



Convert the turning action of an electric motor into distance — you will be amazed at the mileage piled up during its lifetime. Extra years of service, extra mileage is built into Westinghouse motors.

When specifying an electric motor, the type, the speed, the style number are important. But you get the most for your money when you consider Mileage first.

Three features are essential to mileage — to extra years of trouble-free service. Only Westinghouse has all three:

1. **TUFFERNELL INSULATION:** Dual protected windings and taped end turns give extra protection against mechanical and electrical damage.
2. **SEALED SLEEVE BEARINGS:** Exclusive Westinghouse bearing seal keeps clean oil in; dirt, dust and grit out.
3. **RIGID ONE-PIECE FRAME:** Mechanical parts carry the mechanical load, protecting electrical parts from vibration, torque and strain.

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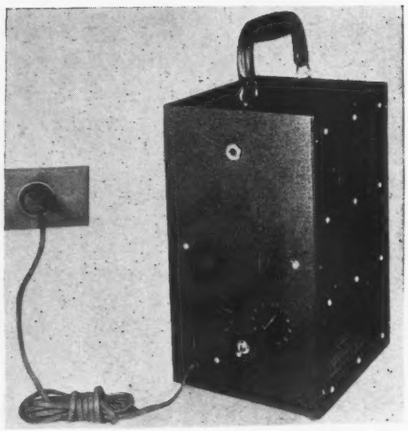
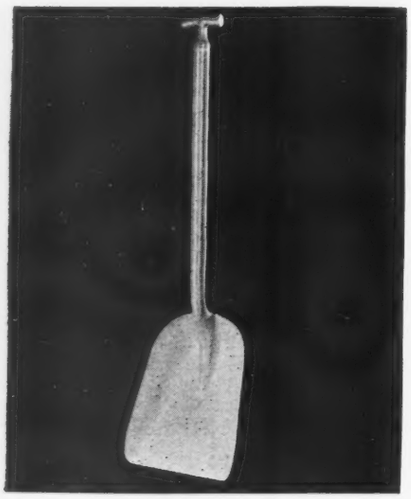


not be silenced by throwing switch to off position, as the alarm is controlled by a combination on the dial, known only to the owner. Unit measures 12x6¾x8 in., and operates from 110-120-volt a.c. or d.c. supply. Teletouch Industries, Inc., 37 West 54th St., New York.

Aluminum Shovel

Aluminum alloy shovel is light in weight, acid-resisting, non-corrosive, and non-sparking. Specially treated aluminum alloy is used so that shovels are both rustproof and acid-resisting to a great degree. Several different models built in various sizes to suit different requirements. The Wood Shovel and Tool Co., Piqua, Ohio.

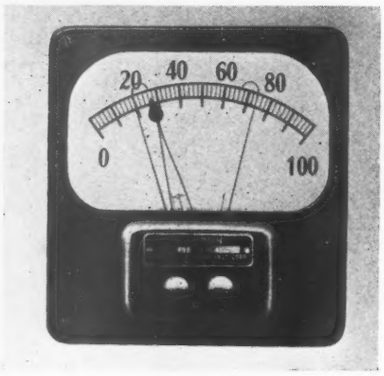


Transmission Belts

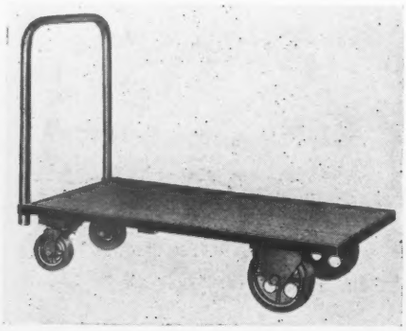
"Paranite-G.O.P." transmission belting is said to be gas- and oil-proof. There is no natural rubber in these belts, the friction compounds being of a synthetic material, used and compounded as rubber. Oil accumulating on the belt will not cause swelling or deterioration. Made in regular transmission belt sizes. The Manhattan Rubber Mfg. Div., of Raybestos-Manhattan, Inc., Passaic, N. J.

Contact-Making Instruments

A line of contact-making instruments, for use where control or limit indication of electrical circuits is desired without affecting the accuracy of the indicating instrument. Models are available with magnetic or non-magnetic contacts. Model 837, the indicator with magnetic contacts, can carry 5 watts at 110 volts a.c. Each contact is separately adjustable over the entire scale. Manual resetting of the contacts is achieved by means of a pushbutton release on the front of the case. Indicators of this type available are: frequency meters, voltmeters, ammeters, power factor meters, wattmeters. Model 838, with non-magnetic contacts, requires no manual reset: otherwise it is the same as Model 837. Weston Electrical Instrument Corp., Newark, N. J.



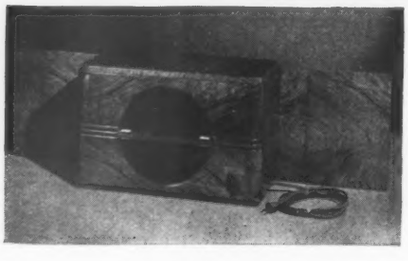
Truck



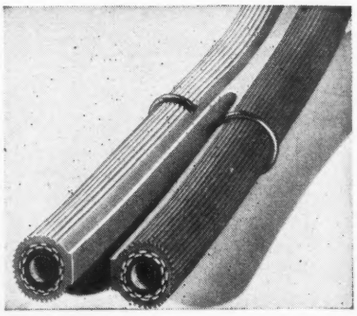
"E-Z Roll Platform Truck" has a hard maple deck, steel bound, and an electric welded frame. Wheels are semi-steel with roller bearings, or can be had with rubber tires. Available in standard platform sizes of 24x48, 24x60, 30x48, 30x54, 30x60, 36x60 in. All Steel Welded Truck Corp., Rockford, Ill.

Air-Filtering Units

"Ilgairator" is a unit placed in window openings to filter dust and soot from incoming air. It contains an electric-fan unit that pulls the air in and recirculates it around the office. Air-flow regulator provides for introduction of air in exact volume desired. Air-mixing control for inside and outside air aids in mixing the air the way wanted. A four-way revolving grille deflects the air in any direction. Made in four adjustable panel sizes; all-metal construction. Ilg Electric Ventilating Co., 2850 North Crawford Ave., Chicago.



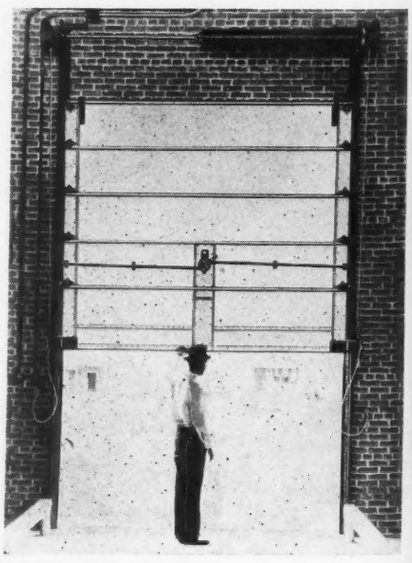
Welding Hose



"Electric-Siameez Hose" is a new grade in the company's line of single-unit, two-passage hose. It is intermediate between the "Supero" and "Junior" Siameez grades. It has two lines of two-braid hose, joined together by an integrally molded web. Designed for service in welding and cutting operations using working pressures up to 200 lb. The cover is thick and tough. End can be separated at the factory, if desired, for attachment to equipment. Made in ¼-, 5/16-, and ⅜-in. sizes. Electric Hose & Rubber Co., Wilmington, Del.

Sliding Door

"Vertical Sliding All-Steel Rol-Top Door" is made up of heavy steel sections. Ends of sections have ball-bearing rollers that travel in steel tracks mounted to the jamb, and extend vertically along the wall. At top of tracks is a torsion spring counterbalance,



operating around a steel shaft. The door is connected to this counterbalance mechanism by steel cable, which operates over drums at the end of the shaft. Has cylinder lock, operating in conjunction with lock bars that engage in slots in the steel track. Doors can be built in any size and in any number of sections. Kinnear Mfg. Co., Columbus, Ohio.

VARI-PITCH SPEEDCHANGER

Exhibition model of the Vari-Pitch Speed Changer now being displayed in various parts of the country.

VARIABLE SPEEDS

Mechanically at 95% Efficiency Mean Lower Overhead and Operating Cost For You

Here is a unit that gives you variable speeds at a higher range than ever before at remarkably low cost. It eliminates at one stroke the necessity of using expensive multi-speed motors, or separate change-overs for every operation requiring a different speed.

That means you can cut your overhead and operating costs to a minimum because the Vari Pitch Speed Changer makes your production flexible without adding unnecessary and bulky equipment. You can run your machines at exactly the speed your operation demands. No steps, no springs, no guesswork. With the Vari-Pitch Speed Changer the speed setting remains constant.

It operates without vibration. It is silent. It is unusually compact. It is 95 per cent efficient — ***the only efficient speed changer on the market today.***

Transmission engineers who have tested the Vari-Pitch Speed Changer declare it will revolutionize speed changing practice just as the Texrope Drive revolutionized transmission practice.

The Vari-Pitch Speed Changer is a product of Allis-Chalmers, originators of the Texrope Drive and the Vari-Pitch Sheave, and is available in ratios of 3¾ to 1 — maximum output speed 3500 rpm. Get in touch with the nearest Allis-Chalmers Texrope representative, and find out how you can cut your production costs through the use of the Vari-Pitch Speed Changer.

TEXROPE DIVISION
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893

SAVE ON SERVICE COSTS

Allis-Chalmers "LO-MAINTENANCE" Motors Are Just What The Name Implies — They're Built for Extra Years of Money-Saving Operation

The best production equipment in the world will not make a cent of profit for you if it is powered by a motor that runs up service costs. Every shutdown increases your manufacturing cost and reduces your plant efficiency. It will pay you to standardize on Allis-Chalmers "Lo-Maintenance" Motors. They are built to give years of continuous service.

Here's the reason. The whole Allis-Chalmers engineering and production organization always has been building equipment for heavy duty and severe service in a widely varied field of industries requiring motors of sturdy design and construction, both electrical and mechanical. These values are passed on to you in the standard line of Allis-Chalmers motors.

Look at this picture of an Allis-Chalmers Seal-Clad Motor. It has been in continuous operation for five years in a chemical plant. It's not pretty to look at now — but it has been doing its job consistently without running up service costs. Check on this story — we can show you where in this, and countless more instances Allis-Chalmers "Lo-Maintenance" Motors have kept the production and profit curve up. Specify Allis-Chalmers when you order motors and save on service costs.

Adverse conditions meant nothing to this Allis-Chalmers "Lo-Maintenance" Motor. It lived up to its name with a record of continuous operation in gas laden atmosphere.

ELECTRICAL DIVISION

ALLIS-CHALMERS

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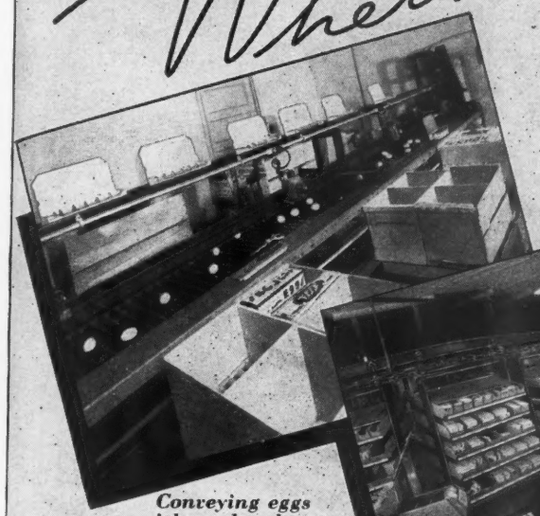

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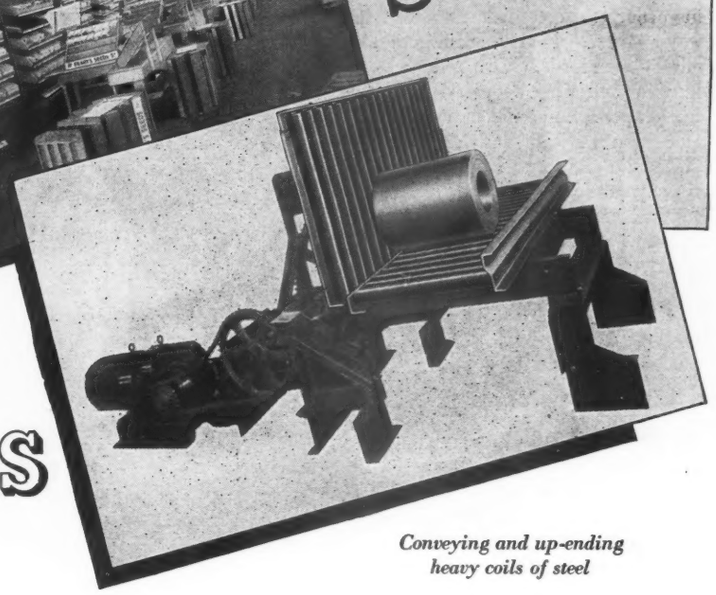
Conveying hundreds of varieties of packaged seeds.



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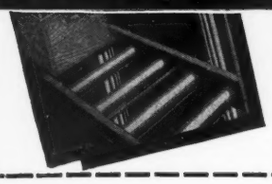

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Operating Shorts

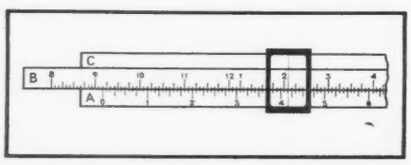
Elapsed-Time Slide Rule

HARVEY JOSEPH, *Assistant to Production Manager, Astorloid Mfg. Co., Inc. Brooklyn, N. Y.*

In this plant the difficulties involved in computing elapsed times on job cards or slips have been considerably reduced. We had to compute these elapsed times in order to establish standard times, wage rates, hourly production, and other standards. To reduce clerical burden and time required for calculating elapsed time, the elapsed-time slide rule was devised and applied. This slide rule gives an automatic calculation, thereby reducing mental fatigue, arithmetical error, and clerical costs.

A 12-in. rule was constructed with *A*, *B*, and *C* scales. The *A* scale was divided into 12 divisions of 1 in. each, each division representing 1 hr. Each ¼ in. therefore represented ¼ hr. The quarter division was subdivided into three divisions, each representing 5 min. The hour divisions were lettered from 1 to 12, thus giving actual hours.

The *B* scale was graduated in the same manner, except for one adjustment. Each hour division was lettered to represent the hour of the day, e.g. 8:00, 9:00, etc. However, in the calculation of elapsed time, it is necessary to omit the non-productive time of the lunch period. Since in our case the lunch



period extends from 12:00 to 12:45, the graduation on the *B* scale between 12:00 and 1:00 is diminished by ¾ hr. Thus, in a calculation where the time extends over the lunch period, this non-productive time is automatically omitted.

In order to find the elapsed time, we merely find the starting time on the *B* scale, place it over the zero on the *A* scale, find the closing time on the *B* scale with the hair line, and read the elapsed time directly below on the *A* scale. For instance, in the illustration, the job was started at 9:10 a.m., ended at 2:05 p.m. Elapsed time, read on scale *A*, is 4 hr., 10 min.

In cases where time clocks stamp in decimal parts of an hour, the following variation works very well. Use a centimeter scale allowing two centimeters to represent an hour. Thus each millimeter will be equivalent to 0:05 hr.

Mr. Joseph's contribution has been awarded the $15 payment offered by the editors for the best Operating Short submitted during the past month.

When hot summer weather comes, it may be advantageous to reschedule heat-producing production equipment to the night and cooler hours of the day.

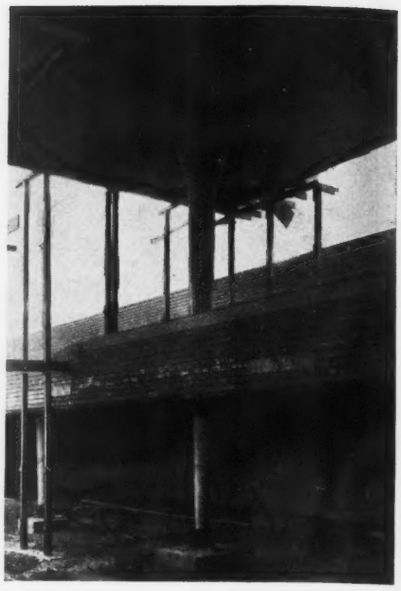
The "Upside-Down" Column

H. T. MOORE, *Madison, Wis.*

Latest contribution to industrial architecture is Frank Lloyd Wright's "upside-down" column, used for the first time in the new administration building of S. C. Johnson & Son, Inc., Racine, Wis.

The new column, described by Mr. Wright as a "flower" column, is 9 in. in diameter at its base, and spreads gradually upward through its "stem." At the top of the "stem," there is a widening of the structure that creates the appearance of a cup. This wider portion is termed the "calyx," from the botanical name, and it supports a large concrete dish, 18½ ft. in diameter, known as the "petal." Petals, spaced 20 ft. on centers, support the building roof. The diamond-shaped roof areas between the edges of the petals are filled with glass, increase the amount of natural light in the plant.

Main columns are 28 ft., 4 in. tall, measured from the bronze shoe at the base to the top of the petal cap, and they have successfully carried a test load of 60 tons. The column is solid for 23 ft. of its height and hollow for the remaining 5 ft., 4 in. Mr. Wright credits the column's great strength to a steel mesh core that he adapted to it. He explained that: "The concrete flows in unison with the steel mesh. It 'marries' the mesh, so to speak." Stem reinforcing is a 9-gage, 1½x3-in. mesh with a cross-sectional area of 0.25 sq.in. The calyx reinforcing is 10-gage mesh,



and the petal reinforcing a 13-gage mesh. Mesh for the stem and calyx is cut, shaped, and welded in the shop. The petal mesh is cut into sections and lapped.

In explaining the functional value of the column, Mr. Wright pointed out: "By tapering the columns to 9 in. at the floor we increase the building's floor space, we use a fraction of the concrete and steel that would ordinarily be used, we cut the cost and at the same time cut the dead weight." He estimated that a conservation of one-third of the space will be effected with the new column.

In the building there will be 82 columns. Greatest weight to be carried by any of them will be from 11 to 12 tons, and the average will be 2 tons.

•

Discouragement for Loose Floor Nails

EMIL J. NOVAK, *Omaha, Neb.*

Nails projecting above the floor surface are always dangerous, since a toe or heel catching on a nail-head will often cause a fall. In a factory or warehouse, where vibration of machinery and trucks causes nails to work up here and there, there is always the danger of injury.

In one plant, a man was detailed periodically to find and knock down the projecting nails. Since accumulations of dirt around the floor joints often made it difficult to see all these nails, he devised a combination tool with which he could more easily locate and drive them down.

The tool consists of a piece of pipe and a solid bar, the bar sliding within the pipe. The end of the pipe that rests on the floor is cut away about one-quarter of an inch for half its circum-

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Shafer provides generous radial-thrust capacity, maintained unchanged under all conditions of practical use, and maintained throughout an unusually long service life. Only the Shafer concave roller design combines:

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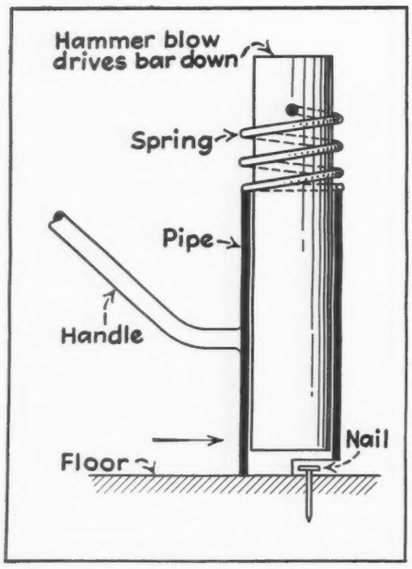


ference. A spring keeps the bar, or driver, from touching the floor, and pulls it back up after it has been struck. A handle, for pushing the tool along the floor, is brazed to the pipe. As the combination scraper-driver is moved over the floor, any projecting nail stops it, and a hammer blow on the upper end of the bar drives the nail down.

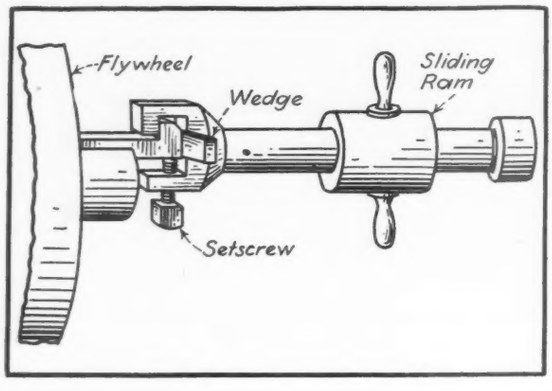
Try dipping a screwdriver in emery dust if it repeatedly slips from the screw slot.

Flywheel Key-Puller

C. H. Willey, *Penacook, N. H.*

Extracting a headed key from a flywheel can be made quite a simple job if this specially designed puller is used. It consists of a forged and machined key chuck on an arbor, and a sliding ram.

The portion that fits the key head has a setscrew to grip and a wedge to back the head, thus making sure to grip the key in the extractor effectively before the removing blows are hit with the ram.

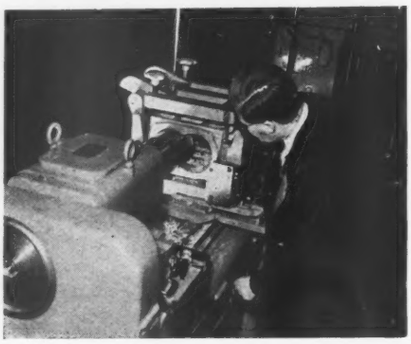


Parts for the One-Cylinder Engine Fit the Six

Source, *Detroit Diesel Engine Division of General Motors Corporation, Detroit*

Faced with the job of designing a line of small diesel engines, varying from one to six cylinders, General Motors engineers went at it determined to make the final product with just as many of its parts as possible interchangeable in all the different engines. Charles F. Kettering, in explaining the line, put it: "We could have shaved a few pounds off some of the smallest sizes by designing the parts for them individually, but the use of interchangeable parts saves so much in production cost that it overcomes the slight additional weight many times over."

The entire line is designed about a single basic cylinder size. Thus all of the parts of a cylinder are made on the same machines, whether for a one-cylinder or six-cylinder engine. Moreover, cylinder blocks and cylinder heads are so designed as to be geometrically similar for all sizes and end-for-end. No matter how you turn the casting, both



ends have the same shape and take the same number and spacing of holes. Ends of all blocks are precisely alike, whether for one or six cylinders, differing only in that the larger block has more holes. But—and here is the point—it also contains all of the holes of any smaller block.

In the machine lines, jigs and fixtures serve an unbelievable variety of parts. Special machines are used for a great number of jobs, but a special machine is able to do the job on parts for engines of all sizes. For example, multiple-spindle drilling and tapping heads are used without change, or merely by adding or removing cutting tools—a matter of minutes—in shifting over from one size to another.

The only difference in design, as the engineers explain it, between the three-cylinder and the six-cylinder engine is that three more cylinders have been added in the middle of the six-cylinder engine, and the crankshaft, camshaft, blower, and so forth, lengthened accordingly. Pistons, valve gear, connecting rods, bearings, pumps, timing gears, flywheel housings, and like parts are all identical for all models, and completely interchangeable.

This similarity of parts and reduction in number of different kinds of parts has tremendously reduced the necessary variety of production machines and machine tools. Volume production methods and low costs are possible on a great many parts that would have to be made by more costly methods otherwise.

Because of the points outlined above, the plant produces engines applicable to a far greater variety of jobs than would at first seem possible. And, as a practical advantage of sales and distribution and service, it makes it possible for a dealer to service any of these engines at any time without a prohibitive investment in parts.

•

Furnace Maintenance Cost 1/5 of 1 Per Cent

Source, *General Electric Company Schenectady, N. Y.*

Five years of carefully kept records show a yearly maintenance cost of less than ⅕ of 1 per cent of the purchase price on a continuous enameling furnace installed at the Cleveland plant of the Enamel Products Company.

The equipment, a 600-kw., 230-volt, 3-phase electric furnace 95 feet long and consisting of a preheating chamber and an elevated heat-sealed firing chamber, was laid out for 2,400 square feet of work an hour. Since installation, however, it has averaged 4,000 square feet an hour or about 600 pounds per hour during a production day of 20 hours.

•

They Can Get the Boat Out of the Basement

Source, *Campana Corporation, Batavia, Ill.*

Foresight is better than hindsight, and particularly important in planning for expansion, maintenance, and replacement. In modern plant buildings, with solid walls and air-conditioned interiors, there is a notable shortage of openings for bringing large pieces of equipment into upper floors.

At this new plant adequate provision has been made, as nearly as can be foreseen. A series of openings, large enough to permit passage of even the largest

"THERE'S A REAL *Quality Story* BEHIND THESE GULF OILS!"

Here is one of the machines Gulf's technical men have devised for testing lubricating oils. The oil, mixed with water, is circulated rapidly through the machine while a stream of oxygen is whipped thoroughly into it. Many oils have been tested with this instrument but none have shown stability equal to Gulf's higher quality oils.

GOOD CRUDES, refined by modern methods, make fine lubricating oils—oils that prove their quality in industry's machines. Performance in actual service is the real test of any product, including oils and greases.

Yet Gulf research engineers have not been content with the usual service tests for Gulf's higher quality lubricants. They have devised laboratory instruments which punish oils far more severely than any machine in industry . . . instruments that find ways to make oils oxidize and break down. As a result of these tests, Gulf engineers then develop oils with such characteristics that they can stand far greater punishment than they will ever receive in normal service. Thus industry is assured of oils that possess a "margin of safety" well beyond average requirements.

There's a real quality story behind Gulf oils and greases. Let a Gulf engineer demonstrate to you—in your plant—how Gulf's higher quality lubricants provide a greater measure of protection for your machinery—and help you reduce the costs of plant operation.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORP. • GULF REFINING CO.

GENERAL OFFICES, PITTSBURGH, PA.

tanks used in the factory, have been left one above the other all the way from the basement ceiling to the top production floor. These are provided with steel covers strong enough to carry any ordinary loads. And in the beams overhead are set large eyes capable of supporting loads heavier than any likely ever to come through those holes.

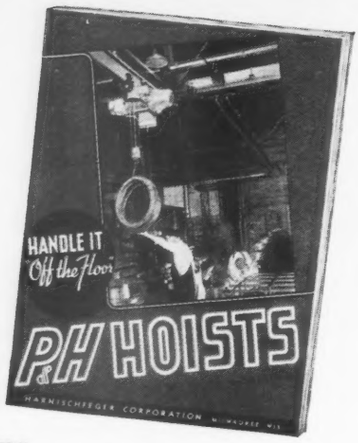
The openings were first used to move in new machines in equipping the plant. But they stand ready for future use whenever new equipment may be added, or old equipment retired. The man responsible for this bit of long-headed planning admits he did it because, in his youth, he built a boat in a basement and then could not get it out.

Similarly, smaller openings have been left and covered with steel plates wherever it is anticipated that present machine lines will be duplicated in future expansion. Even though equipment may be considerably different by that time, it seems probable that packing supplies will have to be used in about the same sequence, and boosters to bring them up from the storage floor below will require floor openings—which are now there, all ready for the boosters.

FREE FOR YOU TO USE

THEY'LL SAVE YOU MONEY

You'll find in this bulletin, many new money-saving ideas selected from the thousands of P&H Hoist installations. It is not unusual for P&H Hoists to cut handling costs as much as 60%! Isn't it time to check up?



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Your name and address on this coupon will bring you a copy of Bulletin H-5, "Handle It Off the Floor." It may show you how to save thousands of dollars. Why not send for it today?

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City..... State.....

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HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

Hood for Locomotive Stacks Stops Cinders

S. H. COLEMAN, *Roanoke, Va.*

Hot cinders from the stacks of locomotives engaged in shifting operations are often a serious fire hazard. This is particularly true where plant buildings are not of fireproof construction, or where the materials processed are of a combustible or explosive nature. In addition to the potential danger of fire, cinders increase housekeeping costs and often impair the quality of the products.

A large chemical plant conducting processes in which quantities of explosive solvents and gases are needed takes care of cinder emission by means of a screen hood for switching locomotive stacks. When this hood is not in use it is suspended by a flexible wire rope from a gallows frame located over the tracks at the point where they enter the plant yard.

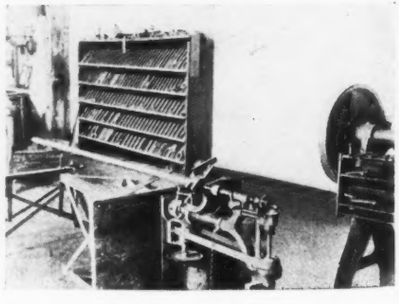
All locomotives entering the yard must stop under the frame where the hood is lowered into place over the stack and the cable is unhooked. When leaving the plant this procedure is reversed. These operations are performed by the train crew, the brakeman handling the cable and the fireman hooking and unhooking the screen.

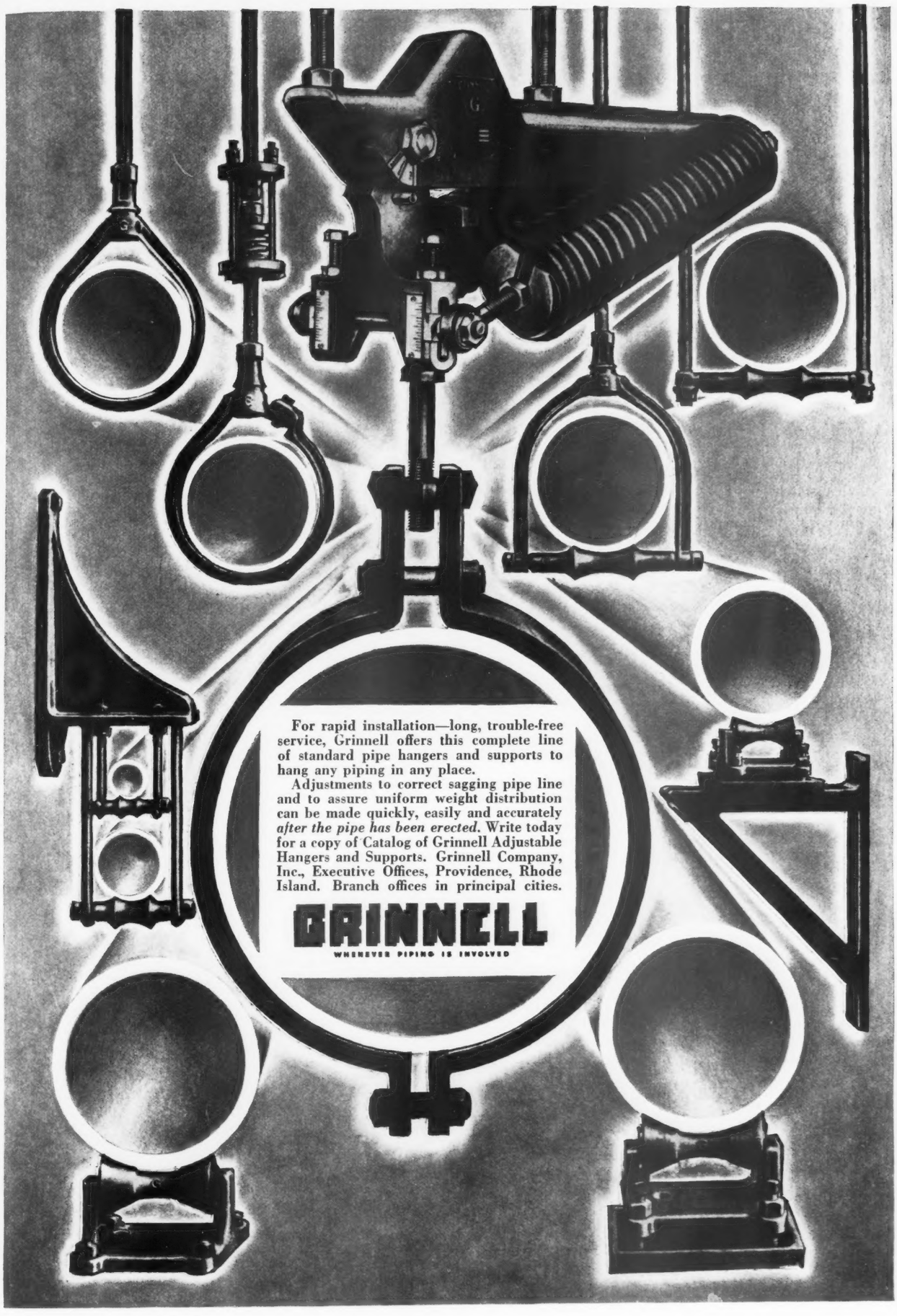
Like many an industrial concern, the Tennessee Valley Authority thought office manuals printed on one side of the paper were easier to revise. But they've found it wasn't so. Now they print on both sides, save paper.

Lies Down on the Job

J. C. COYLE, *Yuma, Ariz.*

When no other equipment was available for drilling the ends of a number of long bars, a small drill press, with direct-connected motor, was converted to horizontal use in a Los Angeles shop. The table on which the press was mounted was turned on its side, and the top of the press was supported on a




For rapid installation—long, trouble-free service, Grinnell offers this complete line of standard pipe hangers and supports to hang any piping in any place.
Adjustments to correct sagging pipe line and to assure uniform weight distribution can be made quickly, easily and accurately *after the pipe has been erected.* Write today for a copy of Catalog of Grinnell Adjustable Hangers and Supports. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities.
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WHENEVER PIPING IS INVOLVED

wooden block. Front end of the work was held in a small vise, clamped to the drill bed with C-clamps, and the back end rested on the usual type of shop trestle.

•

Versatile Paint Machine

PHILIP F. ATWOOD, *Terryville, Conn.*

In our factory we have a small portable compressor for maintenance painting, for which we have found several uses not anticipated when the unit was purchased several years ago.

On a number of occasions it has been necessary to spray lacquer in the finishing department when the power circuits were out of service, and the big compressor could not be operated. We then connected up the portable machine, using the paint container regulators and the regular lacquer guns.

For experimental operations requiring the use of air we have found that the paint machine saved the use of long lengths of hose where the demand for air was not great. Several experimental operations required the use of an air pressure greater than the pressure on the mains in the plant, and, to avoid the necessity of adjusting the air tools around the factory for the temporary increase in pressure, we found the paint machine most valuable.

Our latest use for the machine was to operate a molding machine in the foundry prior to the installation of air lines.

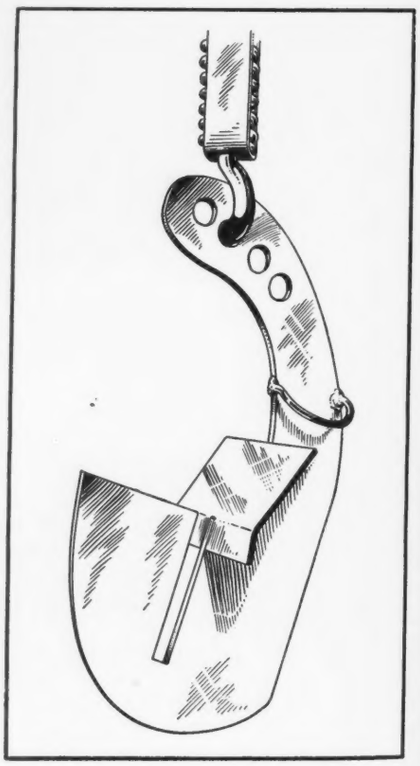
High-level lighting installations at Baker Ice Machine Company, Omaha, Neb., eliminated individual lights over each machine, ended morning task of cleaning machines of dead bugs attracted and killed by the lights while night work was going on.

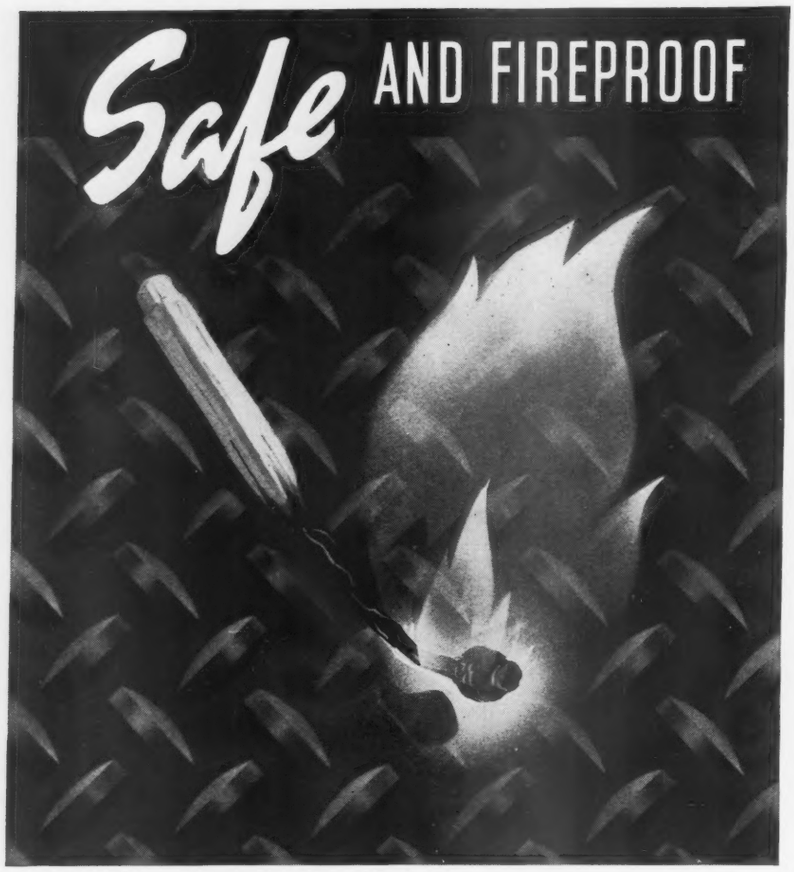
Holds Angle Iron Straight in Punch Press

E. H. TRICK, *San Antonio, Tex.*

Usual method of supporting angle iron while it is being worked in a punch press is an endless chain hung from a spring hook, in turn carried by the hook of a chain block overhead. With this, it is easy to turn the piece, and the operator's helper, by using a claw, can exercise comparatively good control and keep the piece level under the punch.

If he becomes careless, however, the piece is apt to take a position in the press not at right angles to the axis of the descending punch, imposing on that brittle tool the necessity of pushing the





Fires don't start or spread on Inland 4-Way Floor Plate. It's easy to keep clean. Its curved projections form no pockets to collect dirt or grease. It drains quickly, provides equally safe traction in all directions and makes an attractive floor pattern.

Prevent slipping and falling accidents in your plant and avoid frequent floor repair costs. Inland 4-Way Floor Plate carries the load safely year after year. Order it from your distributor, or write today for the Inland 16-page illustrated Floor Plate Book which shows a variety of typical installations.

INLAND 4-WAY FLOOR PLATE

MADE BY THE **INLAND STEEL CO.**, 38 SO. DEARBORN ST., CHICAGO, ILL.

SHEETS STRIP TIN PLATE BARS PLATES FLOOR PLATES
STRUCTURALS PILING RAILS TRACK ACCESSORIES REINFORCING BARS

BRINGS HIDDEN BEARINGS RIGHT OUT IN THE OPEN!

HANDY ALEMITE FILLER TANK
Fills Hand Guns in a Jiffy!

Wherever Alemite Hand Guns are used in a factory, this handy Alemite Filler Tank is indispensable. Filled direct from original lubricant drum, this tank is easily carried about the plant for convenient refilling of hand guns. Holds 35 lbs. lubricant; fills gun with few strokes; keeps lubricant clean and avoids waste.

Invites Easy, Fast, Clean Lubrication ... Safeguards Machinery

Some of the bearings being lubricated by this operator are of necessity very remote. By running tubing from those bearings to the six-stage Alemite Header shown here, International Milling Company has made them easily accessible.

Regular lubrication of every bearing is assured. See those six fittings, *right out in the open — inviting lubrication! They can't be overlooked!* This Alemite Header is more than a time-saver. It's insurance against hot bearings — breakdowns — expensive repairs — and possible fire hazard.

International Milling Company uses Alemite High Pressure Lubrication throughout this big Buffalo plant — *on screw conveyors, reels, bran dusters, line shaft bearings, and other machines.* Alemite Fittings keep abrasive grain dust out of the bearings, and Alemite Hand Guns flush the bearings clean at every lubrication, replacing old worn grease with clean, fresh lubricant.

There is an Alemite System, power or manually operated, which can make short work of your lubrication problem — *perhaps saving its own cost annually in reduced operating expense.* Alemite installation is easy and inexpensive, and can be accomplished without halting production. Write to us!

ALEMITE — *A Div. of Stewart-Warner Corp'n.*
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WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS

Enjoy Horace Heidt and his Alemite Brigadiers every Tuesday Evening, National Broadcasting Company Coast-to-Coast Network, 9:00 p. m., E. S. T.

piece down flat on the die before punching the hole. The violent kick-back of such an operation invariably breaks the punch and leaves a bad hole in the work.

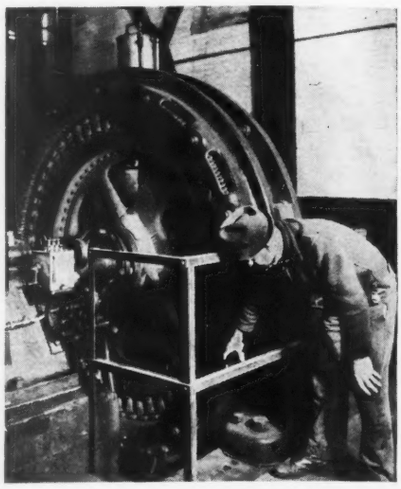
Our operator devised a hanger for angle irons that is shaped something like a boomerang. In the bottom portion is a slot into which the dependent leg of the angle fits, while the curved upper portion has a series of holes into any one of which the spring hook fits.

At the top of the slot is an inclined guide plate that guides the dependent leg into the slot. The series of holes in the upper portion allows a selection to be made so that any size or weight of angle may be held with its horizontal leg square with the axis of the punch. A convenient handle of round rod is welded to the holder's side so that it can be maneuvered easily.

•

Motor Windings Protected by Strip Heaters

During winter months an ice company shuts down two large synchronous motors which are not started again until spring, when the demand for the product picks up. Because the room temperature is low, moisture used to condense on the windings, and several times, when starting up in the spring, the winding insulation broke down. This meant a



hold-up in production and heavy repair bills.

To remedy this trouble, they installed strip heaters on the bottom of each motor frame. During cold weather and for about two weeks before these motors are put back in operation, heat is applied to protect the windings.

Operation of a large fan shook a floor so badly that employees became ill. Since mounting the fan on vibration insulators there's been no lost time due to this type of illness.

How Factory Orders Are Handled

DAVID FLIEGELMAN, *Coppus Engineering Corporation, Worcester, Mass.*

Here is the routine of our factory orders:

The Factory Order is issued by the Order Department. It covers the type and size of machine called for on Customer's order, and should also give additional information, such as special material, special construction, extra fittings, operating conditions, and time of promised shipment. Some or all of this information may have been specified in previous correspondence. The Factory Order is sent to the Enginering Department.

The Engineering Department:

1. Checks the Factory Order to see whether the machine ordered is of the proper size and type to suit the operating conditions as specified on the Customer's Order.

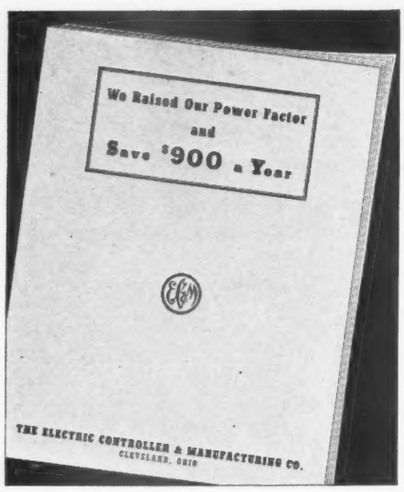
2. Notes on the order the Bill of Ma-

A New Booklet on Power Factor Correction

Showing How One Plant Saved $900 a Year

FREE

to Industrial Plants, Power Companies, Representatives of Motor Manufacturers etc.



THIS BOOKLET describes: ***What causes poor Power Factor —why it is expensive—what steps may be used to determine if poor power factor is present—what methods may be used for correction.***

Now available . . . this new 24-page booklet, just off the press . . . complete discussion of the subject of power factor, written in a non-technical manner to permit quick understanding. Extremely useful and helpful to every industrial plant or institution using a large number of motors. Also available to power companies, synchronous motor manufacturers or their representatives and others interested in power factor correction. Merely fill out and mail the coupon below for your copy. Only a limited supply has been printed —be sure to mail coupon today.

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HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS

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. . . and stop writing checks for replacements!
Every year thousands of dollars are spent needlessly because of the destruction by DUST . . . Learn how to control DUST!
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WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT
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terial, and whatever other information is required by the Machine Shop in building the machine, such as size of nozzles, fan bore, speed of safety trip, etc.

3. Makes up whatever new drawings or Bill of Material may be required.

4. Orders whatever new patterns may be required.

5. Sends the Factory Order to the Machine Shop for execution.

As soon as the Machine Shop receives the Factory Order, the date of promised shipment should be checked to see whether it can be met. If this date *cannot* be met for some reason, such as new patterns, special machining, shortage of castings, etc., the Order Department should be advised at once, and a new shipping date should be proposed by the Shop Superintendent.

After the machine has been built and tested, it is sent, accompanied by the Factory Order, to the Shipping Room. After shipment has been made, the Factory Order is returned to the Order Department for filing. Dates of completion and shipment are noted on the order.

If the machine is built for stock, the Factory Order is returned to the Order Department when the machine has been completed. If the Factory Order calls for a filter, a salmon-colored Job Card must be used, covering all labor required to execute the order.

A Shop Order is issued by the Engineering Department whenever necessary. The Shop Order should specify what machine is to be built, or what other work is to be done, and should give whatever information the Machine Shop may need to complete the job. The Engineering Department sends the Shop Order to the Machine Shop together with whatever drawings may be required. The Machine Shop must always use a Job Card to cover the labor required to execute the order. The color of Job Card to be used is specified on the Shop Order. The Machine Shop also records on the Shop Order all material taken out of stock and Purchase Requisition numbers pertaining to the order. When the work has been completed, the Shop Order is sent to the Cost Department. The Job Cards and the Purchase Requisition should all carry the Shop Order number. Date of completion is to be noted on the order.

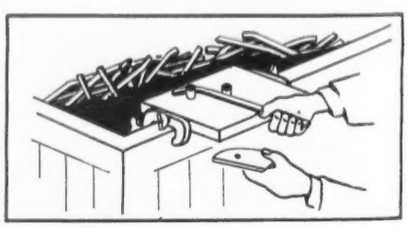
An inspection group stopped having an afternoon letdown in accuracy when it was given mercury-incandescent lighting to work under.

Where a Truck's a Workplace

F. E. Stebley, *Johns-Manville Corporation, Waukegan, Ill.*

Probably every plant has box trucks in which to transport stock during production. Very often a study of operations will reveal that pieces are inspected after they have been placed in the truck. This means that the truck must be moved to inspection tables and rework benches. There is a waste of effort, and production is hampered.

Why not portable inspection and rework benches, right on the truck? The sketch shows how this can be done with an attachment clamped to the truck's side. It's a slab fixture to which sup-



A row of loaded Colson Lift Jack platforms stacked with bulky merchandise. Once packaged, the goods are not handled until shipped.

BAGS, barrels, boxes, odd-shaped loads or what have you—all can be transported the mobile way with Colson Lift Jacks and Platforms. No extra pick-ups...no extra set downs...no extra handling. Goods can be moved at minimum cost.

Two simple units do the trick:

1. A platform or live skid with wheels on one end and legs on the other.

2. A twin-wheeled jack that engages the front end of the platform and converts it into a sturdy and easy-to-roll truck.

Multiply these units by the requirements of your plant and your materials are always completely mobile, while taking up but little or no more floor space than the area of the load.

Inexpensive, too

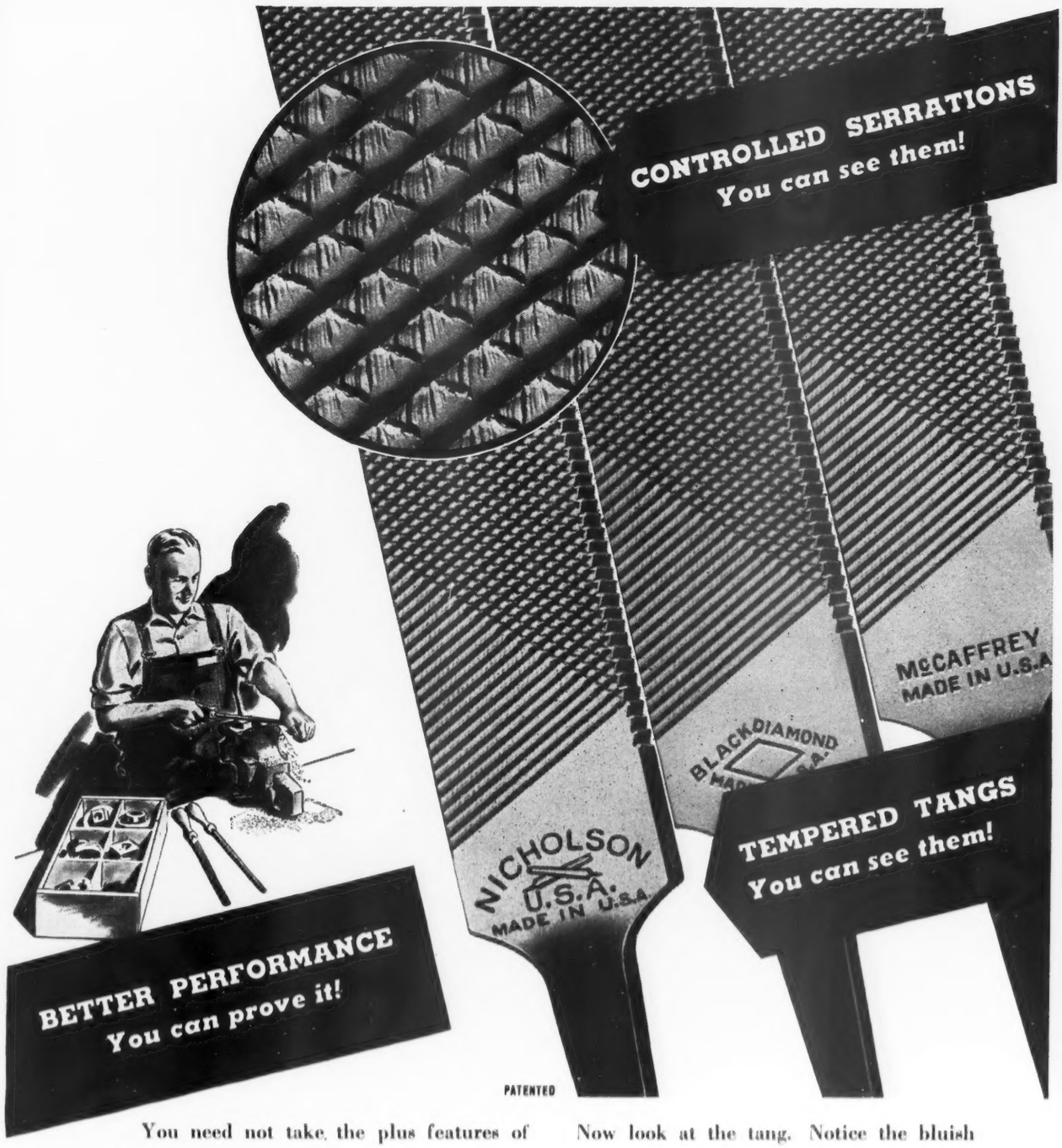
A very small investment will start this system for you. $150 will buy a lift jack and several platforms—no other equipment is needed. A Colson representative will gladly study your material handling requirements and show you how the Colson system saves money.

SEND FOR FREE BOOKLET

The essential facts of Colson Lift Jacks are explained in the booklet: "Colson System of Materials Handling." Write for a copy.

THE COLSON CORPORATION
3707 CEDAR STREET • ELYRIA, OHIO

COLSON LIFT JACK SYSTEM



You need not take the plus features of Nicholson, Black Diamond and McCaffrey Files on anyone's say so. You can easily prove them to yourself.

Examine any one of these files carefully. You can see the Controlled Serrations on the tooth points. This is the Patented Tooth Construction that triples cutting edges—means faster cutting and longer life.

Now look at the tang. Notice the bluish color—always visible on our files. That means that the tang is tempered, guarding you against breakage caused by brittleness.

You can prove the better performance of Nicholson, Black Diamond and McCaffrey Files through daily use in your plant. You'll find that they remove more stock, stay on the line of work better, require less pressure. Mill supply dealers can meet your needs. Nicholson File Co., Providence, R. I., U. S. A.

MADE IN THESE BRANDS
NICHOLSON
BLACK ◇ DIAMOND
McCAFFREY

A FILE FOR EVERY PURPOSE

porting clamps are welded or bolted. The bolts make possible adjustments for various working angles. Pins and stops can be placed on the fixture to serve in gaging pieces or to act as a jig for filing or straightening operations. With an attachment of this sort an entire trucking operation can be eliminated.

•

Concrete Bases Protect Columns at Floor Line

H. C. Sleman, *New York*

Strength of structural steel columns supporting equipment or the building framework is often seriously impaired by corrosion. This is particularly true where they rest on foundations level with plant floors that are frequently wetted with water or corrosive liquids used in some process. Accumulations of dirt in the hard-to-clean corners of the various shapes used as columns accelerate this wasting away by holding the active agents continuously against the metal.

Corrosion can be greatly retarded under ordinary conditions by frequent cleaning and painting of the exposed surfaces. There are many places, however, where much more comprehensive protection is needed.

In one plant where acids and fumes create severe service conditions and make it necessary to protect columns it is the practice to chip out the floor and apply an acid-resistant asphaltic compound, hot, to the lower ends. A concrete base with a sloping top to prevent dirt accumulating on it is then poured around the lower part of the column. This base is also given a coating of the hot compound.

Incidentally, this material is also used to protect the concrete floor wherever acid is likely to come in contact with it.

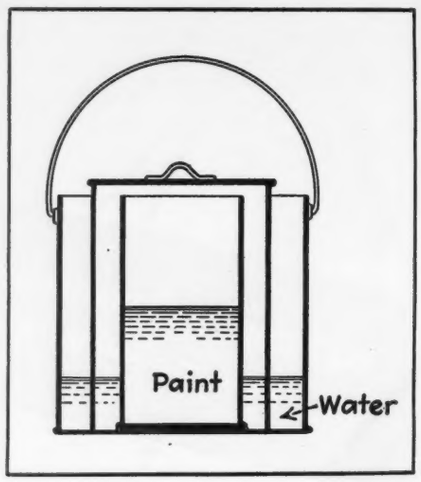
•

Self-Sealing Paint Can

L. Kasper, *Philadelphia*

Maintenance men in our plant frequently use paint for touching-up purposes. To eliminate the necessity for cleaning brushes and sealing cans frequently, this self-sealing can was devised.

The paint is carried in a can that fits inside a larger can, to whose bottom its bottom is soldered. Space between the two cans is partly filled with water. Another can is inverted over the paint container, inside the outer can, the water



acting as a seal to keep out the air. Brushes are carried right in the paint. Since only a small amount of water is required in the outer can, it may be carried about without danger of spilling.

•

Greasy Commutator Caused Voltage Variation

J. Dixon, *Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J.*

When a 500-kw. d.c. generator was started, there was serious oil throwing from the outboard bearing of the engine, covering the machine with oil. After a thorough wiping off, the unit was put in service, and, when run in parallel with

Uniform High Quality—at No Extra Cost

Ryerson certifies to the known uniform high quality of all steels in stock. Tighter, more accurate specifications—rigid inspection and checking—and years of preparation have built up stocks of these better steels.

Ryerson Certified Alloy Steels are particularly outstanding. They are from selected heats that will give the best response to treatment. Special data sheets showing the chemical and physical properties, grain size, cleanliness rating, results of actual heat treatment tests, etc., are prepared. With every shipment Ryerson sends this complete information. The heat treater has an accurate guide for quickly securing the best possible results. These special services are offered without increased cost or obligation.

When you need good uniform steel—a single bar or a carload—order from the nearest Ryerson plant. Immediate Shipment is assured.

Booklet on Ryerson Certified Steels sent on request.

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RYERSON Certified STEELS

FIGURES YOU CAN'T AFFORD TO OVERLOOK

Woolen Mill saves $35000

Costs $1800 • Saves $2400 a month

Shoe manufacturer adds $1,000 extra profit

Fuse-outage interruptions Cost $120 a month

$2,000 a year return on $360 installation

$1500 Circuit Breaker banishes costly delays

Coal production loss Stopped

Automatically protects circuits against severe overloads and "shorts" — without time lost by men and machines and costly fuse replacements.

Safety for circuits
Safety for workmen
Safety for machines

and SAVES many times its cost.

In hundreds of plants Westinghouse Nofuze "De-ion" Circuit Breakers have paid for themselves many times over — reducing lost man hours, stopping the loss of idle machines, lowering maintenance costs.

Be sure you aren't passing up substantial savings. Investigate fuseless circuit protection.

Make a note to look into it today. Call your nearest:

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EAST PITTSBURGH, PA.

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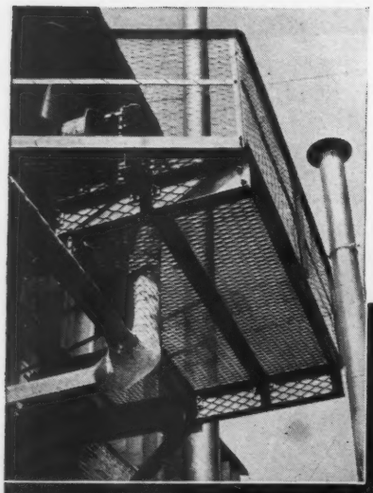
Westinghouse *Nofuze "De-ion"* CIRCUIT BREAKERS

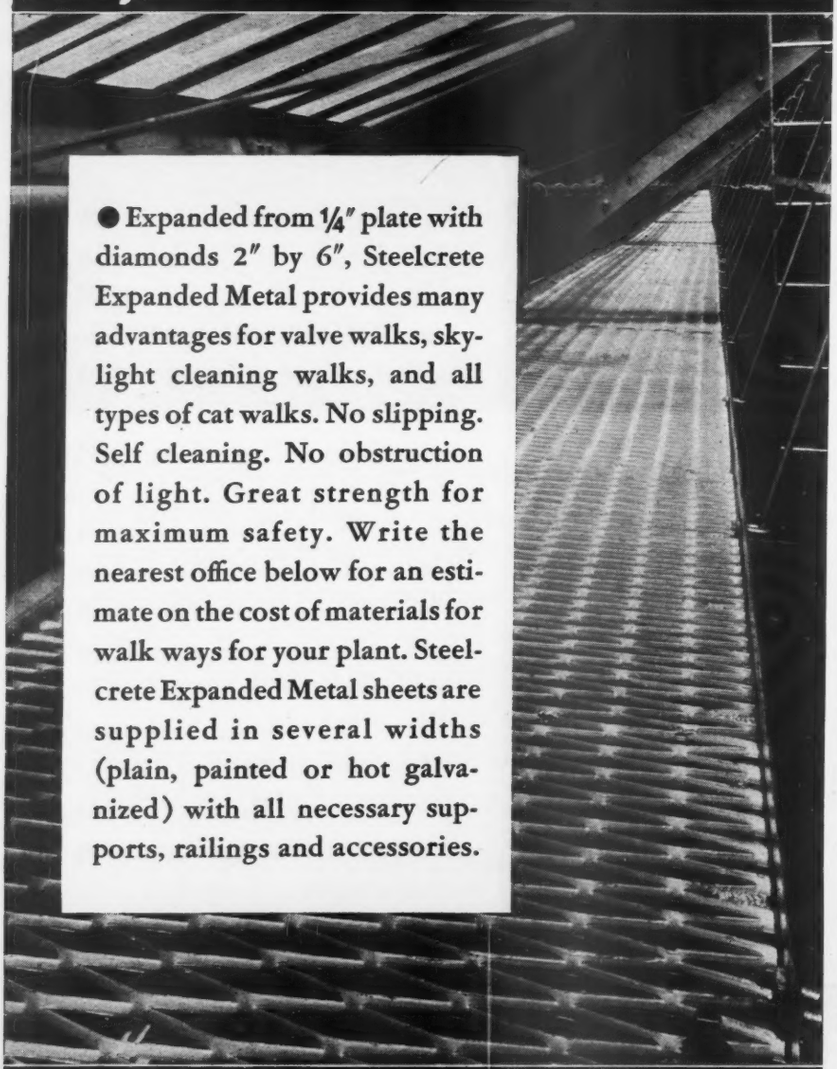
MOTORS • LINESTARTERS • CIRCUIT-BREAKERS • SAFETY SWITCHES • PUSH-BUTTONS



MAKE WALK WAYS OF

Steelcrete

Expanded Metal



● Expanded from 1/4" plate with diamonds 2" by 6", Steelcrete Expanded Metal provides many advantages for valve walks, skylight cleaning walks, and all types of cat walks. No slipping. Self cleaning. No obstruction of light. Great strength for maximum safety. Write the nearest office below for an estimate on the cost of materials for walk ways for your plant. Steelcrete Expanded Metal sheets are supplied in several widths (plain, painted or hot galvanized) with all necessary supports, railings and accessories.

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses:
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Export Office: 330 West 42nd St., New York, N. Y.

other generators, performed properly. When run alone, its voltage was not steady and a recording voltmeter chart produced a jiggly record with a range of several volts.

At times this variation was so bad as to be noticeable in the lamps. Some oil continued to come from the bearing and careful wiping was necessary, particularly on the commutator. The unsteady voltage continued to show on the chart, to the great dissatisfaction of all.

Every connection was taken apart and cleaned, brushes were examined, and tension of the brush holder springs was set to the value recommended by the brush manufacturers. This used up so much of the adjustment that new, heavier springs were put on that gave a minimum tension a little greater than recommended; whereupon the voltage became steady.

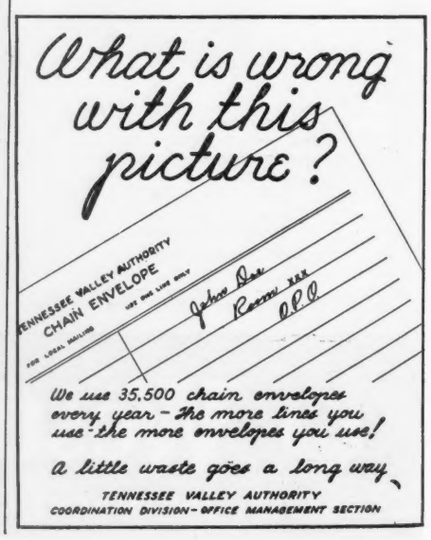
Evidently the presence of a thin, invisible, greasy film on the commutator had been causing the trouble, and the increased brush pressure was enough to force the brushes into better contact. Now, in places known to be oily or dirty, tension of the brush holder springs is increased, and in extreme cases, special brushes are placed around the commutator to scrape off the dirt.

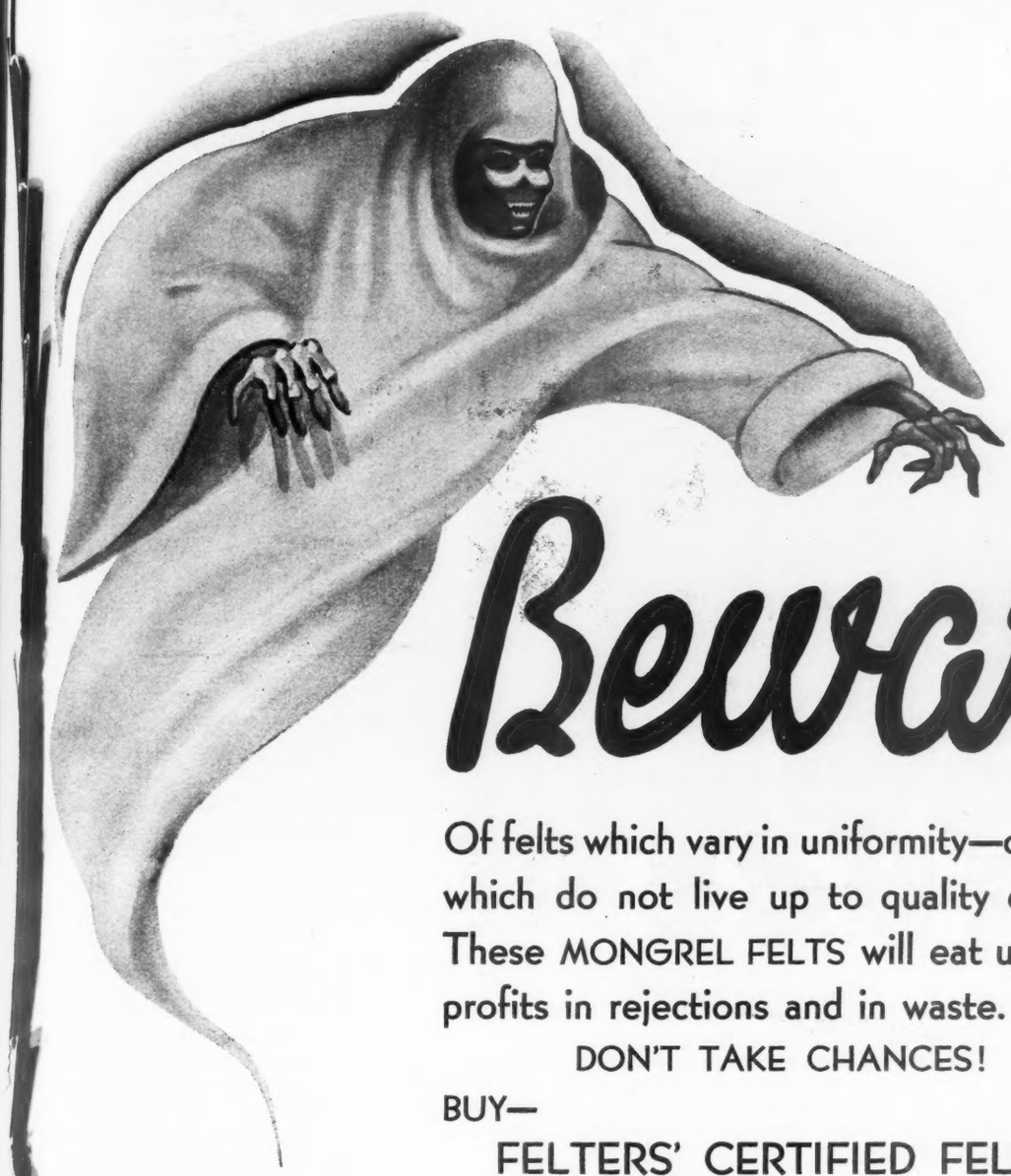
•

Reduced the Waste in a Waste-Saving Program

JOHN F. PIERCE, *Director, Office Service Department, Tennessee Valley Authority*

To stop waste we adopted the slogan, "A Little Waste Goes a Long Way," and used it on a series of posters. The posters depicted simple ways of eliminating waste, such as turning off fans and lights when not needed, signing correspondence early to make prompt mailing possible, combining or eliminating forms when possible, and avoiding long-distance calls.


What is wrong with this picture?
TENNESSEE VALLEY AUTHORITY
CHAIN ENVELOPE
We use 35,500 chain envelopes every year - the more times you use the more envelopes you use!
A little waste goes a long way
TENNESSEE VALLEY AUTHORITY
COORDINATION DIVISION - OFFICE MANAGEMENT SECTION



Beware!

Of felts which vary in uniformity—of felts which do not live up to quality claims. These MONGREL FELTS will eat up your profits in rejections and in waste.

DON'T TAKE CHANCES!

BUY—

FELTERS' CERTIFIED FELTS

And Be Sure!

Look For This Label:

CERTIFIED FELT
Made by
The FELTERS COMPANY INC.
Tested under the supervision of our own Laboratory

REMEMBER that our Certified Felt is DOUBLE-TESTED for quality and uniformity under the supervision of the Felters Company Central Laboratory.

THE FELTERS COMPANY, INC.

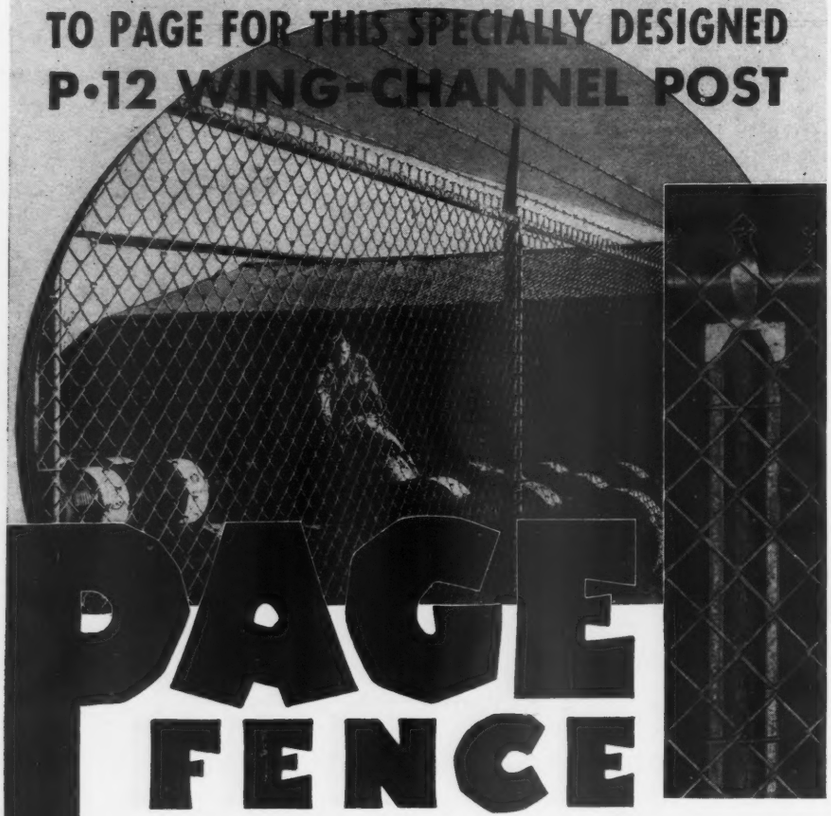
210 SOUTH STREET, BOSTON, MASSACHUSETTS

Mills at Johnson City, N. Y., Millbury, Mass., Jackson, Mich.

Offices at New York, Chicago, Philadelphia, Detroit, St. Louis, Dallas, San Francisco

LOOK

TO PAGE FOR THIS SPECIALLY DESIGNED P-12 WING-CHANNEL POST



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The P-12 Wing Channel Post design provides wider bearing surface for fabric—maximum strength—smart appearance. It exposes no injurious sharp corners. Wings and channel take rigid grip in concrete footing. PAGE P-12 Posts are high carbon steel, heavily galvanized to the high P-12 standard of rust resistance.

5 SUPERIOR FENCE METALS

PAGE FENCE is offered in 5 superior metals to meet all destructive atmospheric conditions. They include Page P-12 Copper-bearing Steel, Page-Armco Ingot Iron, Page-Alcoa Aluminum, Page-Allegheny Stainless Steel in woven wire, and Page genuine Wrought Iron picket fence. The metal best suited to your locality and purpose is impartially recommended by PAGE fence experts.

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AMERICA'S FIRST WIRE FENCE • SINCE 1883

Lightning Against Luck

(Continued from page 86)

tective standpoint to connect the primary arrester ground in with apparatus frames and substation steelwork, so that the primary arrester is in direct shunt relation to the apparatus insulation to be protected.

Driven ground rods represent an effective and economical method of grounding arresters. A sufficient number of ground rods should be driven to the required depth and connected in parallel to obtain the desired low ground resistance. Treatment of the soil by salt or other chemical agents around the driven rods will assist in lowering the resistance to earth. Arrester grounds should preferably not exceed about 5 ohms resistance and wherever practicable the arrester ground should be tied in with the apparatus frame, cable sheath, and so on so that the protective device is in close shunt relation to the insulation to be protected.

Making Interview Count

(Continued from page 63)

prejudiced interviewers, the problem has to be approached in another way. This is done by preparing a standardized interview in which the individual items on which judgments of personality or character are based, are as specific and objective as possible. Instead of simply being asked to make a general estimate of the man's fitness, the interviewer is required to base his conclusions on such particular factual questions as "Did the applicant appear to have made progress in his work?" or "Was he partially or wholly self-supporting while in school?"

The specific content of the interview will vary somewhat in terms of the requirements of the positions for which it is to be used. In general, however, it is best that it follow a definite pattern.

A typical form of this sort is reproduced on the facing page. It consists of four main groupings of items, followed by a rating sheet. These individual items are each followed by a space in which a judgment concerning them can be recorded. Nevertheless, these are not questions that are asked directly of the person interviewed. They are simply points on which information is to be obtained in the course of an apparently informal conversation. It is immaterial whether these items are covered in the order shown or not. It is important only that some time during the interview the discussion is led to deal with these topics.

Usually the interview is opened by asking the candidate to tell about his previous work. This is a natural and logi-

"33% HIGHER SUSTAINED PRODUCTION"

One of the Westinghouse Combination units used in the modern Christie Machine Shop, San Francisco, California, shown at the left.

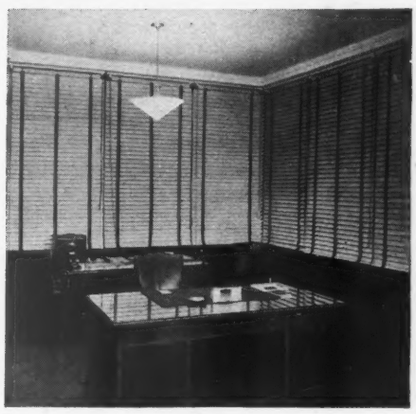
. . . WITH WESTINGHOUSE COMBINATION LIGHTING

During the first full year of operation in this modern machine shop, a record of *33 per cent higher sustained production* was made for nighttime as compared with daytime work!

No small part of the credit for this showing was attributed to the high-grade lighting system installed. This system consists of 21 Westinghouse lighting units . . . 10 of which are Combination High Intensity Mercury and Incandescent. Ten are "straight" H. I. Mercury; and one is Incandescent only. All are mounted at 23 feet from the floor.

Each of the Mercury and Combination Mercury units has its own ballast transformer, mounted directly above the reflector. Each is connected to the suspension conduit by means of the exclusive Westinghouse "Safe-Change" hanger . . . which permits the Mercury fixtures to be shifted wherever needed in the shop for correction of stroboscopic effects. The net result of this lighting system is a "flood of light over the whole shop," as a recent visitor aptly expressed it. Actually the average intensity is 21 footcandles at the working plane. Divisions and markings on gauges and micrometers are more clearly seen under such lighting conditions. Blueprints and whiteprints are read more easily. Accuracy is increased and rejects are few.

What is good for mechanics is also good for draftsmen, the office force, and the boss in this plant . . . where Westinghouse Magnalux Luminaires provide 22 footcandles of shadowless, glarefree light in private and general office areas. For full particulars on Westinghouse lighting service, call your local Westinghouse jobber; or write direct to Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.



The Christie Machine Works uses Westinghouse Lighting also in their private and general office areas, where Magnalux luminairies are installed.

Westinghouse is a member of

RLM STANDARDS INSTITUTE

WHEN YOU THINK OF *Lighting Equipment* THINK OF

Westinghouse

HOW CHEAP ARE CHEAP TOWELS?

Judge by the "cost per user" *not by the* "price per case"

Don't be misled by bargain prices on paper towels. You may save a few cents per case, but you lose out on "drying power." Because of its extra size, strength and absorbency, a single cloth-like Onliwon equals several ordinary paper towels in "drying power." And *that means economy!* To make doubly sure that waste is prevented, Onliwon Towels are dispensed one-at-a-time from locked cabinets.

Doctors recommend Onliwon Towels to keep contagious disease from spreading. Each towel is *used just once by just one person*. The sanitary cabinet prevents contamination from dust, dirt, and promiscuous handling.

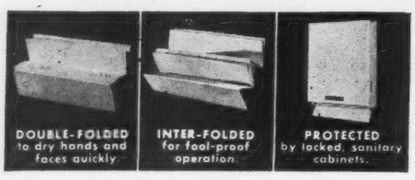
Onliwon Towels promote employee good-will and encourage cleanliness. Clean hands insure your goods and packages against soiling. Many manufacturers install Onliwon Cabinets and Towels throughout the factory as well as in the washrooms.

It will pay you to find out about the money-saving, health-guarding features of the Onliwon service. Call your local A.P.W. distributor, or write for samples to: A.P.W. Paper Co., Albany, N. Y.

A.P.W.

Onliwon Towels

PREVENT "WASHROOM INFECTION"


DOUBLE-FOLDED to dry hands and faces quickly.
INTER-FOLDED for fool-proof operation.
PROTECTED by locked, sanitary cabinets.

cal starting point. From this point, the candidate more or less determines the course of the conversation. The interviewer only makes such comments and asks such questions as are necessary to keep the discussion from wandering too far afield.

Of the greatest practical importance, however, is the opportunity offered by this type of interview to catch hints or suggestions of material which the candidate wishes to conceal. Perhaps his statements are not entirely consistent. Or he may make passing reference to some episode or experience that suggests an undesirable trait or attitude. At once the interviewer follows up this clue with further questions. If nothing further of significance appears, the matter is dropped. Otherwise, this lead is followed until everything it may yield is brought out.

The individual items to be covered during the interview are selected principally with a view to exposing the candidate's weaknesses. If his work history shows no improvement from job to job, investigation may reveal that it was because of personality peculiarities. A record of many jobs held only a short time may be similarly illuminating. A history of chronic dependence on others to obtain work is suggestive of infantile characteristics.

Why Did He Leave?

Reasons for leaving previous positions can be especially enlightening. This single item is usually the most productive in the entire interview. It is here that evidences of personality unbalance or maladjustment and infantilism are most frequently encountered. It is at this point that the most transparent justifications or excuses appear, and when broken down by adroit questioning give the clearest proof of emotional inadequacy and distortion.

The rating scale is valuable for recording impressions that are not related to specific items. This is particularly true of the section on motivation. As a summary of general impressions gained in the preceding four sections, this is especially important. Here may be recorded the man's attitude toward the job as a whole, the forces that will be most significant in his success or failure.

Of particular significance in selecting men for more important positions is the section devoted to domestic relationships. Studies of successful and unsuccessful men have shown with monotonous regularity the importance of a man's wife and his total domestic situation in determining the course of his career. Again and again, men with every qualification for success in themselves have failed because of their wives. Instead of being sources of help and encouragement, the

How to Control Washroom Costs with

PAX ADJUSTABLE FEED SOAP DISPENSERS

To get to the heart of your soap waste problem in washrooms, look at your soap dispensers. If you are not using PAX Dispensers with their exclusive Adjustable Feed, you cannot have any control over the amount of soap dispensed and waste that naturally follows.

But on PAX Heavy Duty Dispensers, you can adjust the feed to dispense soap exactly to requirements. For heavily begrimed hands, you can set the feed to dispense a larger amount of soap . . . for lighter duty, the feed can be cut down. Location and service demands may be met to a nicety.

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Real washroom economy is achieved through the use of PAX Soap in PAX Dispensers. PAX is a highly efficient granulated soap which cleans thoroughly yet harmlessly. It contains no scratchy mineral scrubbers or harsh, unneutralized cleansing agents. It is kind to the skin and keeps hands in prime condition.

Real soap savers, PAX Dispensers are ruggedly built to withstand abuse. Easily attached to wall, water pipe or group wash fountains, they keep soap dry, clean and usable. Fully protected by patents, they offer advantages unobtainable elsewhere.

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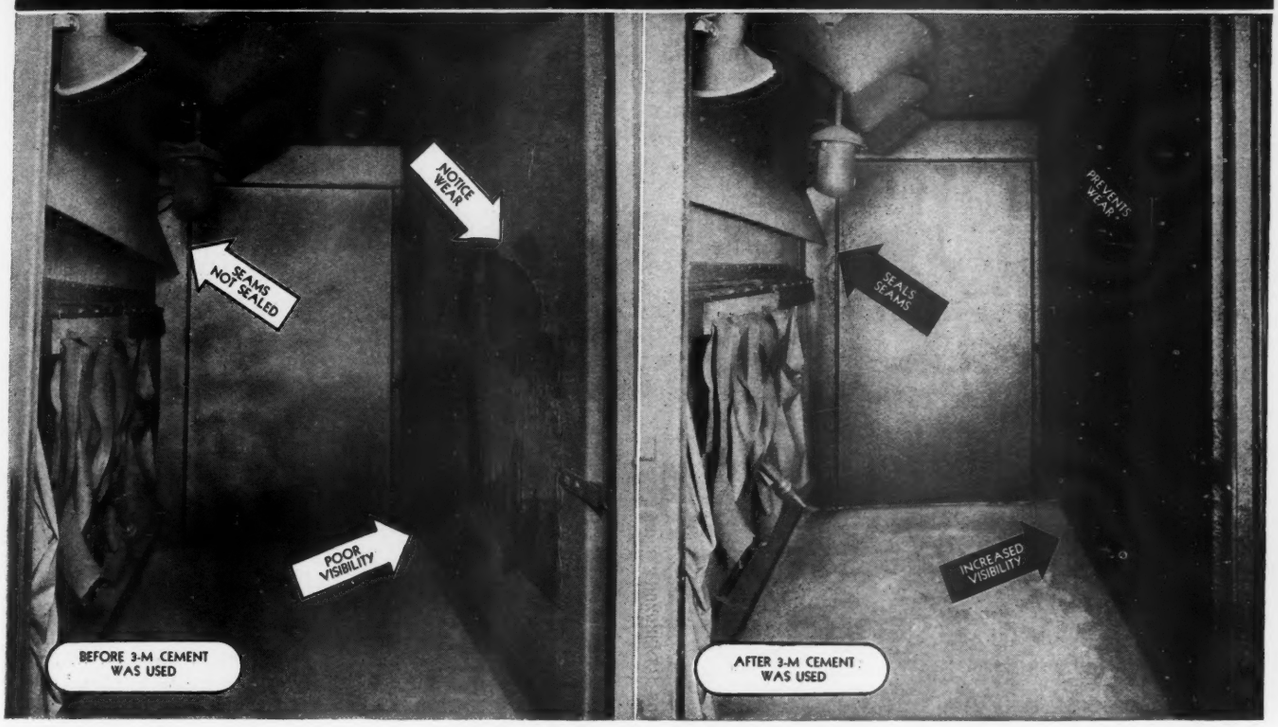
STOP DUST LEAKS . . . . PREVENT WEAR . . . .
in Sandblast Booths and Accumulator Ducts



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Another Member of the 3-M Cement Line that Aids Production, Reduces Manufacturing Costs, Increases Visibility, Controls Occupational Hazards

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10 REASONS WHY BUYERS SELECT YALE CHAIN HOISTS

Because . . . the SUPREMACY of Yale Ball Bearing Spur-Geared Chain Hoists has never been interrupted. Built by the oldest as well as the largest manufacturer of this type of equipment, Yale Chain Hoists have an international reputation for QUALITY and that quality is based on the outstanding features of construction, as follows:

1 Heavy forged steel safety hook and cross head designed to withstand shock.

2 Heavy wrought steel suspension plates support the load between the top hook cross head and load sheave.

3 The load sheave on which the load is lifted is a massive special analysis steel casting.

4 The driving pinion is a one-piece forging of special steel.

5 Ball bearings upon which the load sheave is mounted are of high carbon chrome alloy steel running in chrome vanadium steel races.

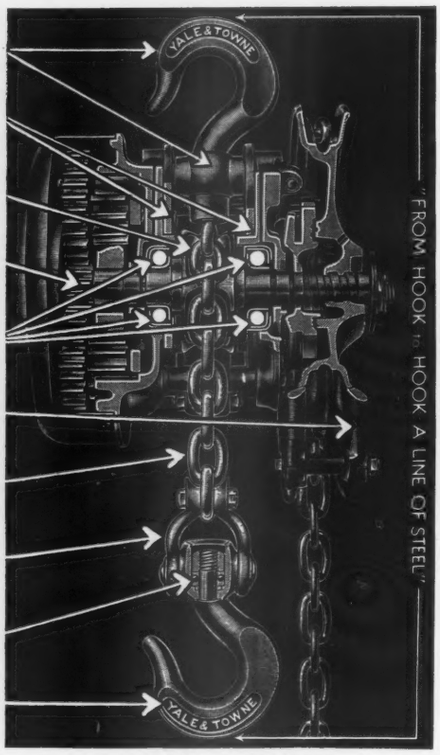
6 A continuous and adjustable hand chain guide which prevents snagging and fouling of hand chain, made of tough malleable iron having a tensile strength of 50,000 pounds.

7 The load chain is of steel, welded and heat treated.

8 Drop forged two-piece shackles with heat-treated suspension pin permit changing or replacing load chain without welding.

9 Lower hook is equipped with heavy duty ball bearing, completely enclosed, packed in grease, requires no further lubrication.

10 Steel safety hook opens slowly without fracture before any other part of the hoist is overstrained — protects operator and load.



Capacities 300 Lbs. to 40 Tons

Note: All Yale Hoists are tested to 50% overload—long ton rating, 2240 lbs.

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The Yale Distributor is no further away from you than your telephone. The hundreds of Industrial Supply organizations who feature Yale Products cover the entire country. In every industrial center they are business leaders, serving industry swiftly, efficiently and economically. Yale Chain Hoists and allied equipment are sold only through Yale Distributors—in order to provide American industry with the fastest, most satisfactory kind of service.

TRADE YALE MARK

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

wives have kept their husbands poor by their inordinate spending, chained to them by chronic ill-health, or distracted by their constant nagging and whining.

Other and weaker men have often gone on to success simply because they were fortunate in having wives who stood behind them and worked with rather than against them.

It is extremely difficult to get a true picture of most men's domestic circumstances by an interview with the man alone. Often a man is unwilling to admit even to himself the gravity of the mistake he has made.

A final virtue of an interviewing procedure of this type lies in its value in the training and checking of those engaged in the work of making the actual selections. Kept on the desk before them during the course of the interview, it insures that no points of significance will be overlooked. Designed for the simple and unobtrusive recording of judgments on each point, a permanent statement of the interviewer's conclusions is available for each candidate.

This latter, moreover, has a double supplementary value. First, during the training of each interviewer, a means is at hand for checking the validity of each of his judgments because the candidate can easily be re-interviewed on disputed points. If he has made a mistake, its exact nature can easily be shown him. Second, after the interviewer's training period is ended, the permanent record can be used as a basis for periodic spot check on the care and honesty with which he is conducting his interviews.

No Substitute for Experience

No procedure for the selection of men to fill supervisory or executive positions, at least as thus far developed, can guarantee complete reliability. Certainly no method has been worked out that will assure automatically and infallibly successful choices. In every case the procedure used must be supplemented by the application of good common sense. Consequently, the procedures which have been described are meant for use, not as a substitute for, but as a supplement to, long experience and a thorough knowledge of the work for which the selection is to be made.

Under such circumstances a program of the sort which has been outlined can have a definite value. If it is based upon a careful, empirical study of successful employees, it ceases to be a random, trial-and-error procedure, but can give definite promise of improving the reliability of the choices where it is used. If employed intelligently, it should be of distinct value in avoiding many of the expensive errors which come about through the placing in executive positions of men without the proper personality make-up.

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6,000 HOURS WITHOUT RELUBRICATION

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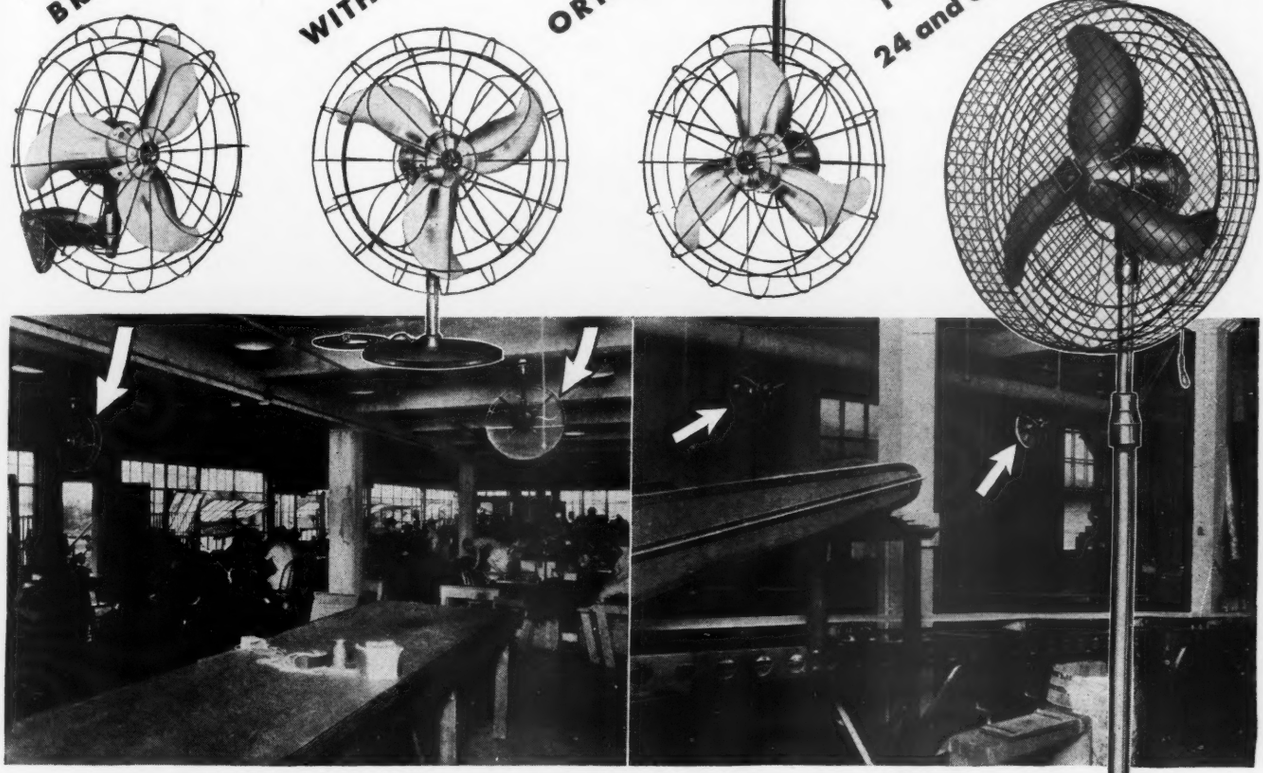

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Here's a way to step up production through the grueling summer months that your workers will applaud and appreciate. Put Emerson-Electric High-Velocity Man Coolers in behind that excessive heat, stagnant air or nauseating odor—and watch it disappear—workers become more congenial, contented, and efficient.

Emerson-Electric High-Velocity Man Coolers, favorites of factories the nation over, are available in seven models, each with adjustable floor-column, counter-column, ceiling or wall-bracket mountings. Heavy-duty, grease-packed, ball-bearing motors give 6,000 hours (3 average seasons) of continuous service without relubrication. Where necessary, wire mesh guards are available. Complete or spot installations can be made quickly. For the most efficient, low-cost method of eliminating "fatigue loss" and increasing efficient production, install Emerson-Electric Man Coolers and Exhaust Fans. Write today for Emerson-Electric Bulletin No. 140.

Clear the Air with Emerson-Electric Exhaust Fans

Emerson-Electric Exhaust Fans remove steam, fumes, excessive heat and do the job quietly, effectively. Five sizes—2-speed, ball-bearing and single-speed, sleeve-bearing fans. Automatic outside shutters for all sizes. Write today for booklet "How to Select Emerson-Electric Exhaust Fan Equipment" No. 141.

New!

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Equipped with new Capacitor Motor which cuts current costs 24%, this powerful 3-speed factory safe fan is capable of delivering a large volume of cooling, penetrating breeze economically. Backed by the famous Emerson-Electric 5-Year Factory-to-User Guarantee. Write today for new 1938 Emerson-Electric Fan Catalog No. 158.

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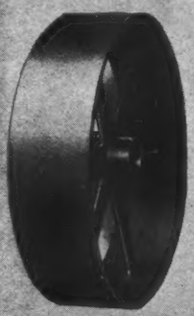
WOOD'S PULLEYS

FOR RIGIDITY AND PERFORMANCE CAST IRON PULLEYS ARE BETTER!



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Star Hack Saw Blades have stood for quality and leadership since 1849. The first molybdenum steel blades were pioneered by the famous Star copper-finished "Moly." Now, the new lithographed copyrighted boxes of metal are another Star achievement.

There is a reason for such success . . . your distributor can tell you.

"HAND AND POWER – TUNGSTEN AND "MOLY"

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"PACKED IN MODERN METAL BOXES

The **BROWNING CRANE & SHOVEL Co.**

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40 YEARS OF **LEADERSHIP**

CRAWLER, TRUCK AND WAGON SHOVELS DRAGLINES CRANES • HOES

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RAIL CRANES SHOVELS DRAGLINES ZEE ROTATORS

BROWNING PRODUCTS

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What the 40-Hour Week Did to France

(Continued from page 70)

genuine employment than before. In fairness, it cannot be said that this is a *direct* consequence of the shorter week, but conversely this incidence cannot be denied altogether. It can only be surmised that the 40-hour week, by raising costs, led to a stronger measure of price inflation and currency depreciation than would otherwise have been necessary.

Failing an increase in production, price inflation is tantamount to a contraction of purchasing power. There was no increase in production. Everything points to the contrary. Indirectly, therefore, the shorter week, in leading to reduced production, seems to have adversely affected employment.

Wages Buy Less

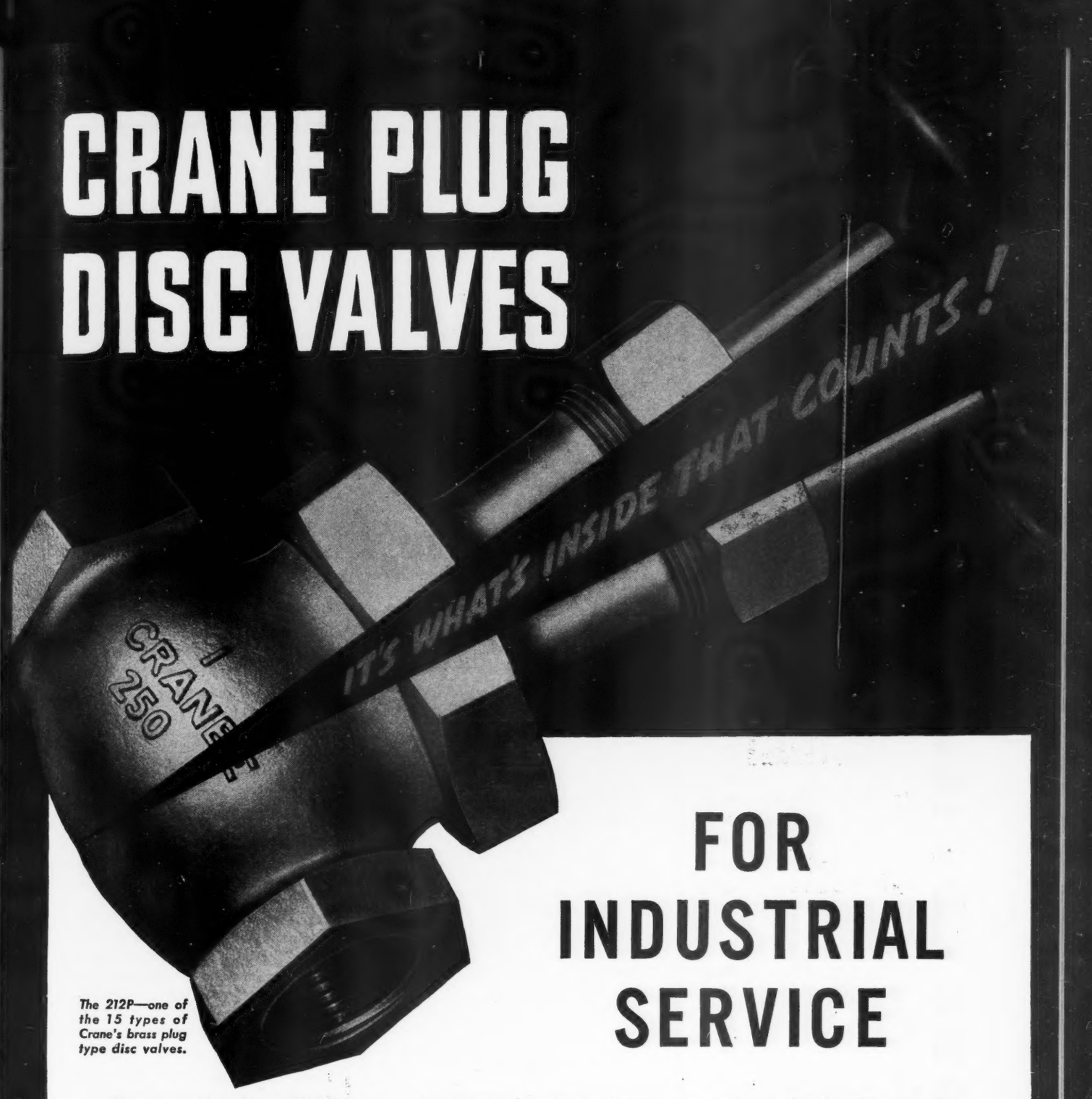
To the extent that figures are available, they all tend to show a considerable reduction in purchasing power. Although the process of deterioration has been speedier and more striking in middle-class and funded incomes, workers' real wages have barely maintained their old levels, notwithstanding strikes and awards which have from time to time brought about an upward revision of wage schedules.

It is beyond doubt that the shorter week has greatly complicated French economic problems. Indeed, its application came at a most untimely moment. Prices were rising the world over. The French price level was non-competitive, since devaluation had long been overdue. French internal prices had been going up gradually for the preceding ten months or so. Insufficient analysis of the labor market led to an overestimation of possible 40-hour benefits in the field of unemployment. The necessity of importing foreign labor in times of improving business was completely overlooked.

It would not be difficult to show that many hardships of application could have been avoided with a little more thinking. For instance, more attention could have been paid to the interdependence of certain industries, trades, and services. The preference given to the 5 days/8 hours system of application in the loading and unloading of goods at railway stations, for instance, and in the hauling of goods as between such stations and the places of production has led to unnecessary disturbance in production schedules, through lack of timely delivery of raw materials and semi-finished products.

As a final sum-up, it cannot be said

CRANE PLUG DISC VALVES



The 212P—one of the 15 types of Crane's brass plug type disc valves.

FOR INDUSTRIAL SERVICE

Here's a valve that will safely control 250-pound steam at 500° F. even in the toughest spots—a valve that you can operate in partly opened position or open and close frequently with the assurance that it will give longer and more economical service.

It's what's inside that counts in valve construction and the 212P plug disc valve is one example of the soundness of design and thoroughness of engineering that are a part of all Crane valves.

For example, consider the disc and seat. Crane laboratories have found that no one metal is suitable for every service. In the 212P, the disc and seat are made of different metals—neither too hard nor too soft—and it is this combination that offers the highest resistance to cutting, wire-drawing, erosion and corrosion under actual service conditions.

But important as it is, the disc and seat construction is only one part of a Crane plug disc valve. The same care in selection of metals—the same fine consideration by Crane engineers for careful design, extra strength and perfect balance in every part are responsible for the superior service you may expect from a Crane 212P.

Why Crane plug disc valves are more suitable for the toughest services in your plant, is fully explained in our new booklet "The Inside Story of Crane Plug Disc Brass Valves." A copy will be sent you upon request. There is no obligation.

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Plastic Rock Made All the Difference

That's the experience of a "Big 3" automobile manufacturer on a *shipping platform.* One type of floor after another had failed. Replacements averaged 90 days apart. Plastic Rock shows virtually no wear after three years . . Plastic Rock units come to you complete. Mix with water, trowel over your old floor, and use in 24 hours. Skid-safe, dustless, silent, wear-defying.

About 50,000 sq. ft. of roof, the understructure weakened by vibration, repaired *the right way.* We have the right process for your felt, metal, wood, slag or concrete roof. There are eleven ULI Certified Processes. Results guaranteed up to 16 years. Prompt attention to inquiries.

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NOW... FLOORS WEAR 3 YEARS AND NO SIGN OF MAINTENANCE

FORMERLY . . . 3 MONTHS AND "ALL SHOT"

that the present experiment enables one to draw definite conclusions as to the ultimate practicability of the 40-hour week in French production. The experiment has not been permitted to develop independently of extraneous influences such as public finances, a misguided economic policy during depression, the tariff factor, devaluation, and politics. It would be rash to condemn the 40-hour week absolutely and *en bloc.* It would be just as rash to praise it as an unparalleled social benefaction.

Looking at it from the short-term viewpoint, it has so far had more immediate disadvantages than advantages. It has hampered French economy in extricating itself from depression. It has aggravated social antagonisms, hence political antagonisms. It has contributed, for the time being at least, to a general reduction in the standard of living. It has weakened French rearmament. In short, it has proved a social luxury which France would have been well advised to put off until better times.

Against this heavy indictment, there can be set the less immediate effect of the shorter week as a stimulant toward progress in technique and organization. It will take several years before its incidence on public health can be measured. In the meantime, distillery balance sheets will furnish some indication.

As far as rearmament is concerned, the tense political situation in Europe will no doubt lead to a temporary stretching of working time by common agreement between capital and labor. Many signs point to this solution. This may prove the first step away from the dogmatic attitude taken both by the defenders and the opponents of the second Sabbath.

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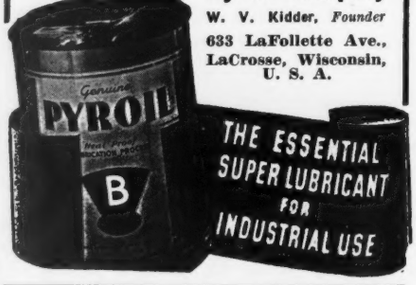
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